SECTION 1*

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

*Section 2 is 1955 Index

UNIVERSITY MICROFILMS
313 N. 1ST ST.
ANN ARBOR, MICH.
COMP

New in 1955 — Filtration Plant at Warren, Ohio

Modernized Accounting and Service Procedures

Gallatin, Tennessee's, Sewage Treatment Plant

JANUARY 1956

THE LINE THAT HELD

At Waterbury, Conn., this Lock Joint Reinforced Concrete Cylinder Pipeline, undermined by flood waters, gave trouble-free service, alleviating a critical water shortage.

Although sections of this 48" Lock Joint water supply line for Hartford, Conn. were uncovered by the flood, it continued to give satisfactory service.

The destiny of England once hung on Wellington's "thin, red line" at the Battle of Waterloo. Daily your community's safety from fire and epidemic depends, to a large degree, on its water supply and sewage lines.

When the backwash of Hurricane Diane inundated western New England, the many Lock Joint installations in the area stood firm. These lines, in some cases the main source of water supply or of sanitary sewage disposal, continued to give trouble-free service even when uncovered and undercut by raging flood waters.

Such rugged pipe deserves your consideration. Its strength is evident, its initial high carrying capacity is permanent, and its useful life is exceptionally long.

LOCK JOINT PIPE CO.

East Orange, New Jersey

Sales Offices: Chicago, Ill. • Columbia, S. C. • Denver, Col. • Detroit, Mich. • Hartford, Conn. • Kansas City, Mo.

Pressure • Water • Sewer • REINFORCED CONCRETE PIPE • Culvert • Subaqueous

ALL NEW DESIGN!

Simple...Foolproof...Low Cost

1500 WATT HOMELITE GENERATOR

Model 35A115
Homelite Generator
1500 Watts, 115 Volt
60 Cycle AC

As easy to move as an electric hand saw!

1. New Money-Saving features . . . No DC brushes; just two easy-to-get-at collector ring brushes . . . No commutator or DC windings . . . No intermediate couplings; armature keys directly to shaft. Fewer parts to wear out — longer trouble-free generator service.

2. Constant Voltage . . . less than 4% change from no load to full 1500 watt capacity . . . assures long service life for your electric tools . . . guarantees top performance at all times.

3. Overload Capacity . . . 1500 watt continuous duty with generous overload capacity prevents tool stalling under heavy loads . . . insures uninterrupted service even when starting loads exceed operating loads.

4. Compact and Lightweight . . . one man can easily carry this generator wherever you need electricity to power time-saving electric tools. No need for long, hazardous power-consuming cables.

Whatever tools you want to operate — electric saws, drills, floodlights, grinders, belt sanders, hammers, — the new Homelite 35A115 generator can save you money. For a free demonstration or additional information, call your nearest Homelite representative, or write:

SAVE EVEN MORE! New Homelite electronic idle control unit, available as optional accessory, runs engine at idle speed when no current is drawn . . . automatically brings engine to full speed when load is applied.
Ask your Homelite representative to show you how this easily-installed accessory reduces engine wear . . . increases service life . . . cuts fuel consumption.

HOMELITE *A DIVISION OF TEXTRON AMERICAN, INC.*
701 RIVERDALE AVE., PORT CHESTER, N. Y.
Manufacturers of Carryable PUMPS • GENERATORS • BLOWERS • CHAIN SAWS

AUTOMATIC HARDNESS TESTER on each softener makes soap tests at required intervals. When the water tests hard—regardless of the volume treated—the tester automatically activates the multiport valve that regenerates the softener . . . insuring maximum runs and uniformly soft water despite variations in wells.

AUTOMATIC MULTIPORT VALVE, being checked by operator Bob Fox, takes a softener out of service, backwashes, regenerates and rinses the bed and returns the unit to service—smoothly and automatically—with no attention or supervision.

East Aurora goes "automatic" and cuts water-softening costs

WHEN POPULATION JUMPED TO 6,800, East Aurora increased pumpage by 72% from 320,000 to 550,000 gpd. Even at this increased volume, they cut salt costs $4000 a year! They also ended a red-water problem by reducing iron from 1.3 ppm to 0. And they use the *same manpower!*

HOW WAS IT DONE? The increased volume and salt savings were accomplished by using Permutit Q, a high-capacity ion exchange resin with low salt consumption. The iron problem was solved with two Permutit filters. Manpower was not increased because the automatic hardness testers eliminated manual testing. And the efficiency of Permutit's automatic multiport valves frees the operators for other plant duties.

WHY PERMUTIT? "We started with Permutit equipment in 1935, and it worked out so well that we called on Permutit again for our 1950 expansion," says Village Engineer E. J. Maurer.

PERMUTIT WILL WORK WITH YOU to modernize your present plant or to plan a new one. Call us early in the planning so we can be of most help. The Permutit Company, Dept. W-1, 330 West 42nd Street, New York 36, N. Y.

PERMUTIT® WATER CONDITIONING

Equipment • Resins • Experience

A 51% increase in population caused East Aurora, N. Y. to expand and modernize its water works. Wooden structure (above) was replaced by a modern brick building which contains the latest in water conditioning equipment.

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL

COMING ARTICLES

Sewerage and Sewage Treatment—1955: Developments and Trends ..... *Eliassen*
Water Service Regulations: Improvement Through Standardization ..... *Smith*
Copper Sulfate, an Aid in Manganese Removal ..... *Chambers & Ingols*
Some Recent Experiences in Taste and Odor Control ..... *Hyndshaw*
Control of Hydrogen Sulfide Generation in Sewers ..... *Pomeroy*
Water Utility Responsibility to the Customer ..... *Clark*
Lubrication Experience with Plant Equipment ..... *Tschida*
Motor Starting Problems in Pumping ..... *Boggis & Potthoff*
Notes on Water Works Law (A Continuing Series) ..... *Murdoch*
Sewage Works Practices (A Continuing Series) ..... *Bloodgood*

E. SCRANTON GILLETTE
Publisher

•

LINN HARRISON ENSLOW
Editor

•

HERBERT P. ORLAND
Associate Editor

Assistant Editor, F. C. MAURER
Make-Up Editor, Mrs. A. H. SKATES
Feature Writer,
GEORGE E. SYMONS, Ph.D.

•

Editorial Associates
A M RAWN J. R. BAYLIS C. E. KEEFER
L. L. HEDGEPETH

•

EXECUTIVE OFFICE

185 North Wabash Ave., Chicago 1, Ill.
E. S. Gillette, *President & Publisher*
H. J. Conway, *Sec.-Treas. & Adv. Dir.*

EDITORIAL OFFICES

155 East 44th Street, New York 17, N. Y.
Linn H. Enslow, *Vice-Pres. & Editor*
F. C. Maurer, *Assistant Editor*
310 W. Church St., Champaign, Ill.
Herbert P. Orland, *Associate Editor*
Mrs. A. H. Skates, *Make-Up Editor*

BUSINESS OFFICES

Chicago: 185 North Wabash Ave.
Terence McCoy, *Western Mgr.*

New York: 155 East 44th Street
Evans J. Kall, *Eastern Mgr.*
William R. Joyce, *Cent. Dist. Mgr.*
Hale H. Darey, *Sales Rep.*

West Coast: 1709 W. 8 St., Los Angeles
Don Harway & Co., *Rep.*

Copyright 1955 By Scranton Publishing Co.

Vol. 103 **JANUARY 1956** **No. 1**

Water Supply Progress in 1955 1
by Frank C. Amsbary, Jr.

Modernized Accounting and Service Procedures 7
by Stanford I. Roth

Head Loss in Butterfly Valves 10
by H. W. Hamm

Air Operation of Flow Controllers and Gauges in Austin's New Plant 12
by A. A. Kalinske and A. H. Ullrich

Unusual Water Main Job 18
by Daniel J. Conlon

Mixing and Sedimentation (26th of a Series) 20
by G. E. Symons

Frozen Asbestos Cement Pipe Thawed with High-Pressure Steam 26
by Elliott J. Hale

Centrifugal Pumps—Part 9 27
by Roy Carter and Igor J. Karassik

Gallatin, Tennessee's, Sewage Treatment Plant 31
by Cecil G. Acree

The Membrane Filter: Advantages and Disadvantages 36
by A M Rawn and F. R. Bowerman

An Inexpensive Underwater Effluent Line 38
by W. E. McFee

Recent Advances in Sludge Digestion (2nd of a Series) 40
by Theodore Jaffe

Activated Sludge Froth Control 44
by John L. Wooten

Why a Businessman Became Mayor 45
by J. P. Lawlor

Editorial 46

Meetings Scheduled 82A

New Equipment 92A

Manufacturers' New 98A

Literature and Catalogs 105A

WATER AND SEWAGE WORKS is published monthly with an extra issue in June. Subscriptions including the Reference and Data issue in the U. S. and Canada, 1 year $3.00; 2 years $4.50; 3 years $6.00. Other countries $1.50 per year additional. Single copies 25¢ except Reference and Data issue 50¢.

WATER AND SEWAGE WORKS, Reg. U. S. Patent Off. Published monthly by Scranton Publishing Co., at 5th and Ferry St., Lafayette, Ind. Entered as second class matter at the post office at Lafayette, Ind., under Act of March 3, 1879.

THE MEMBERSHIP OF A

96% OF ALL 6-INCH AND LARGER CAST IRON WATER MAINS EVER LAID IN 25 REPRESENTATIVE CITIES ARE STILL IN SERVICE.
Based on the findings of a survey conducted by leading water works engineers.

CAST IRON PIPE

DISTINGUISHED CLUB...

The Cast Iron Pipe Century Club is probably the most unusual club in the world. Membership is limited to municipal, or privately-owned, water and gas supply systems having cast iron mains in service for a century or more. Although the Club is formally constituted, there are no dues, no regular meetings, and no obligations other than to inform the Recording Secretary if and when the qualifying water or gas main is taken out of service, or, sold for re-use.

In spite of the unique requirements for membership, the Club roster grows, year by year, from 18 in 1947 to 73 in 1955. Members comprise 38 *water* and 35 *gas* utilities, in cities large and small, from the Pacific to the Atlantic, from Canada to the Gulf.

If your records show a cast iron main in service, laid a century or more ago, the Club invites you to send for a handsome framed Certificate of Honorary Membership. Address Thomas F. Wolfe, Recording Secretary, Cast Iron Pipe Century Club, Peoples Gas Bldg., Chicago 3, Illinois.

C. I. P. CENTURY CLUB NOW HAS 73 MEMBERS!

ALBANY, New York
Department of Water and Water Supply
ALBANY, New York
Niagara Mohawk Power Corp. (Gas)
ALEXANDRIA, Virginia
Alexandria Water Company
*ALLENTOWN, Pennsylvania
Bureau of Water
BALTIMORE, Maryland
Bureau of Water, Dept. of Public Works
BALTIMORE, Maryland
Consolidated Gas Electric Light and Power Co.
BOSTON, Massachusetts
Public Works Dept., Water Division
BOSTON, Massachusetts
Boston Consolidated Gas Co.
BOUND BROOK, New Jersey
Public Service Electric & Gas Co.
BRIDGEPORT, Connecticut
Bridgeport Gas Light Company
BUFFALO, New York
Department of Public Works, Division of Water
CHARLESTON, South Carolina
South Carolina Electric & Gas Co.
CHICAGO, Illinois
Peoples Gas Light & Coke Company
CHICAGO, Illinois
Water Works Department
CINCINNATI, Ohio
Cincinnati Gas & Electric Co.
COLUMBIA, Pennsylvania
Columbia Water Company
DETROIT, Michigan
Board of Water Commissioners
DETROIT, Michigan
Michigan Consolidated Gas Co.
*EVANSVILLE, Indiana
Southern Indiana Gas & Electric Company
FALL RIVER, Massachusetts
Fall River Gas Works Company
FREDERICK, Maryland
City of Frederick Water Dept.
FREDERICK, Maryland
Frederick Gas Company, Inc.
CITY OF FREDERICKSBURG, Virginia
Gas Department
HALIFAX, Nova Scotia
Public Service Commission, Public Water Supply
HARTFORD, Connecticut
The Hartford Gas Company
HARTFORD, Connecticut
Water Bureau of the Metropolitan District
HUNTSVILLE, Alabama
Municipal Water Works
INDIANAPOLIS, Indiana
Citizens Gas & Coke Utility
LANCASTER, Pennsylvania
Bureau of Water
LOUISVILLE, Kentucky
Louisville Gas & Electric Co.
LYNCHBURG, Virginia
City of Lynchburg Water Department
MADISON, Indiana
Natural Gas Service, Inc.
*MINERSVILLE, Pennsylvania
The Municipal Authority of the Borough of Minersville
MOBILE, Alabama
Mobile Gas Service Corp.
MOBILE, Alabama
Mobile Water Works Company
MONTREAL, Quebec
Quebec Hydro-Electric Commission
MONTREAL, Quebec
Public Works Dept., Water-Works & Sewerage Division
*NASHUA, New Hampshire
Pennichuck Water Works
NASHVILLE, Tennessee
Waterworks Department
NEW BRUNSWICK, New Jersey
Public Service Electric & Gas Co.
NEW HAVEN, Connecticut
New Haven Gas Company
NEW ORLEANS, Louisiana
New Orleans Public Service, Inc. (Gas)
NEWARK, New Jersey
Public Service Electric & Gas Company
NEW YORK, New York
Department of Water, Gas & Electricity
NORRISTOWN, Pennsylvania
Philadelphia Electric Co., Gas Dept.
PAINESVILLE, Ohio
City of Painesville, Gas District Department
*PEORIA, Illinois
Central Illinois Light Company
PHILADELPHIA, Pennsylvania
Department of Public Works, Bureau of Water
PHILADELPHIA, Pennsylvania
Philadelphia Gas Works Co.
PITTSBURGH, Pennsylvania
Bureau of Water, Department of Public Works
PLYMOUTH, Massachusetts
Plymouth Gas Light Company
POTTSVILLE, Pennsylvania
Pottsville Water Company
PROVIDENCE, Rhode Island
Providence Gas Company
QUEBEC, Canada
Quebec Power Company, Gas Division
READING, Pennsylvania
Bureau of Water
RICHMOND, Virginia
Department of Public Utilities (Gas)
RICHMOND, Virginia
Department of Public Utilities (Water)
ROCHESTER, New York
Rochester Gas & Electric Corp.
SACRAMENTO, California
Division of Water & Sewers
ST. JOHN, New Brunswick
Water & Sewerage Department
ST. LOUIS, Missouri
Department of Public Utilities, Water Division
SALEM, Massachusetts
North Shore Gas Company
*SPRINGFIELD, Illinois
Central Illinois Light Company
SYRACUSE, New York
Water Division, Department of Engineering
TORONTO, Ontario
The Consumer's Gas Co. of Toronto
TROY, New York
Department of Public Works
UTICA, New York
City of Utica, Board of Water Supply
WHEELING, West Virginia
City of Wheeling Water Department
WILMINGTON, Delaware
Wilmington Water Department
WINCHESTER, Virginia
Water Department
WINSTON-SALEM, North Carolina
Water Department
YORK, Pennsylvania
York Water Company
ZANESVILLE, Ohio
Water Department

*New Members in 1955

SERVES FOR CENTURIES

CAST TO LAST 100 YEARS

The name "CLOW" cast on the face of cast iron pipe is your guarantee of high quality. This distinctive "autograph" marks the precise, modern production methods and the advanced, exacting control of metallurgical quality employed by Clow to assure you the finest cast iron pipe.

Four generations of waterworks operators and municipal officials have looked to Clow for high quality and good service. Clow cast iron pipe exceeds the physical requirements of all currently approved specifications. We would welcome the opportunity to serve you.

JAMES B. CLOW & SONS

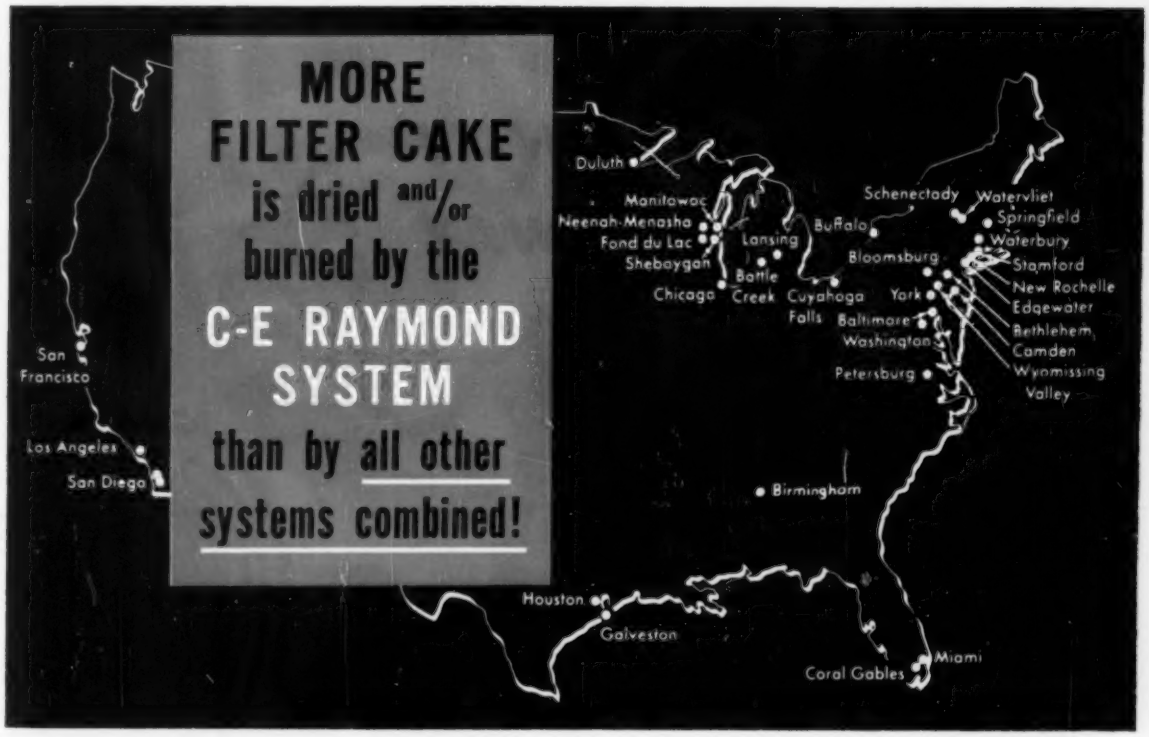
INC.

201-299 North Talman Avenue • Chicago 80, Illinois

Subsidiaries:

Eddy Valve Company, Waterford, New York

Iowa Valve Company, Oskaloosa, Iowa



There's good reason why all over the country disposal plants for cities of every size are taking advantage of the C-E Raymond System's versatility. It is the *only system* available today that allows you to flash dry or incinerate sewage sludge — *alternately or concurrently, in any proportion.* Furthermore, it is available with a high-temperature deodorization system that eliminates odors.

Whether you wish to incinerate filter cake — or dry it to a marketable soil conditioner — a C-E engineer will be glad to help you plan an installation for your community. Just call the Combustion office nearest you.

COMBUSTION ENGINEERING

RAYMOND DIVISION

1315 North Branch Street, Chicago 22, Illinois

Eastern Office:
200 Madison Avenue
New York 16, N. Y.

Western Office:
510 West Sixth Street
Los Angeles 14, California

also flash drying and incineration systems for industrial waste disposal

B-895

A booklet describing the operation of the C-E Raymond System is now available. For your copy, mail this coupon to Combustion Engineering, Raymond Division, 1315 North Branch Street, Chicago 22, Illinois.

NAME_____

TITLE_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

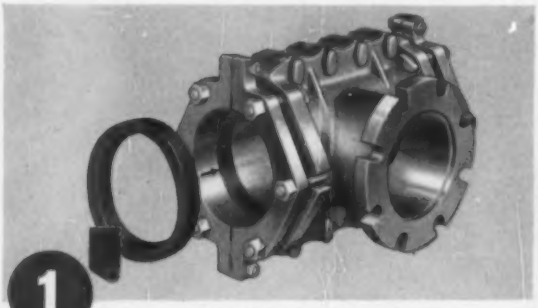
R-101

For tapping mains under pressure

THE *EDDY* WAY

IS THE EASY WAY

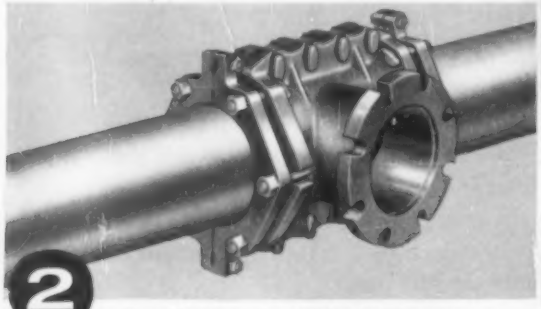
faster, simpler, too!



1

Strength To Withstand Tapping Strain

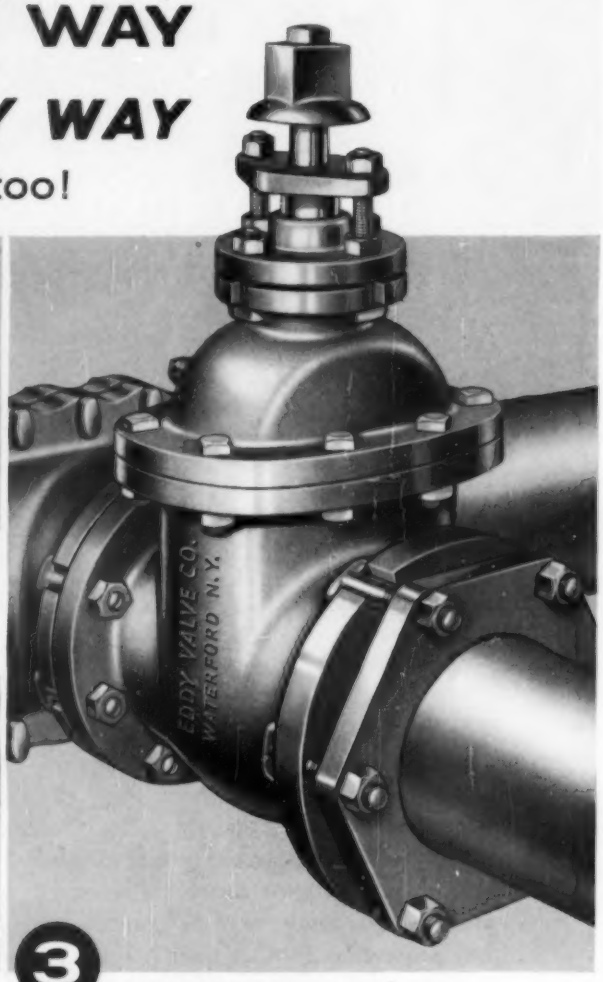
The extra length and heavy-duty, ribbed construction give strength to withstand strain of the tapping operation. Helical spring in gasket prevents extrusion between pipe and sleeve. Always a tight, permanent seal!



2

Fits All Pipe—Assembles In Minutes

Specially designed, armored gasket seals end flanges . . . and fits either AWWA or centrifugally cast pipe diameters. One man can assemble the Eddy Mechanical Joint Sleeve in minutes . . . even in a wet trench . . . with only a ratchet wrench. Tee-head bolts fit in notched flange . . . can't slip or turn when assembling.



3

And After The Tap Is Made . . .

. . . the standardized mechanical joint of the Eddy Tapping Valve permits fast assembly of the pipe for the branch line. Eddy Mechanical Joint Tapping Valves offer the same rugged, quality construction of *all* Eddy AWWA valves . . . that give years and years of dependable service.

EDDY *mechanical joint tapping valves and sleeves*

No Service Interruptions When You Connect Branch Mains the Easy, EDDY Way

Here's the most practical . . . and economical . . . way to connect branch mains. So simple even unskilled labor can do it right . . . every time. So sure you needn't ever worry about interrupting water service . . . no need closing valves to shut off mains . . . no bother to users.

Both sleeves and valves in sizes 4 inches through 12 inches.

EDDY VALVE COMPANY

A Subsidiary of James B. Clow & Sons, Inc.

WATERFORD, NEW YORK

A SPACE STATION . . . a thousand miles high in the stratosphere slowly circling the globe . . . observers near its rim studying cloud formations and the earth's atmospheric conditions below . . . this may be our weather bureau of the future.

100 years from now... A MAN-MADE "MOON" MAY BE OUR WEATHER BUREAU

OUR WORLD of tomorrow will bring many changes. But in one vital aspect of American living, your great-grandchildren will continue to enjoy the same dependability and service you know today. *Cast iron pipe laid today will still carry water and gas to their homes.*

Today, over sixty American cities and towns are still served by cast iron water and gas mains laid 100 and more years ago. And modernized cast iron pipe, centrifugally cast, is even stronger, tougher, more durable.

U. S. Pipe is proud to be one of the leaders in a forward-looking industry whose service to the world is measured in centuries.

U.S. cast iron PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE
CAST IRON

United States Pipe and Foundry Company
General Office: Birmingham 2, Ala.

A wholly integrated producer from mines and blast furnaces to finished pipe.

ACT NOW!

eliminate "orphans" from your fire protection system . . . with

IOWA

GATE VALVES and FIRE HYDRANTS

Don't Gamble on Obsolete Equipment

. . . BE READY FOR ANY EMERGENCY!

"Forever" is such a long, long time. In this H-bomb age, we hesitate to promise that replacement parts for Iowa Hydrants and Gate Valves will be available "forever." But we'd like to—because, actually, replacements are readily available today for every part of every hydrant and gate valve Iowa ever has made. That's a record that extends way back to 1909—almost a half century ago. It's a record we plan to maintain. So, this much we can say: You're as "safe as safe can be" in replacing NOW with time-proved Iowa. For full details, please write TODAY!

IOWA HYDRANTS

Provide full, truly unrestricted water way.

Open with the pressure for faster water delivery.

Close against the pressure to eliminate water hammer, provide flushing action.

Assure positive drainage.

Are available for any type of connection.

All working parts removable through top—no digging or special tools required

Meet all A.W.W.A. specifications.

IOWA GATE VALVES

Double disc, parallel seat.

Positive wedging action for efficient, no-leak closing.

Gates hung loosely from stem nut—no binding.

Rugged, time-proved design means long life, low service costs.

Available with bell, flange, or mechanical joint connections to fit any existing or planned installation.

Meet all A.W.W.A. specifications.

IOWA VALVE COMPANY

Oskaloosa, Iowa • *A Subsidiary of James B. Clow & Sons*

YOU BUY

Simplicity

When you buy

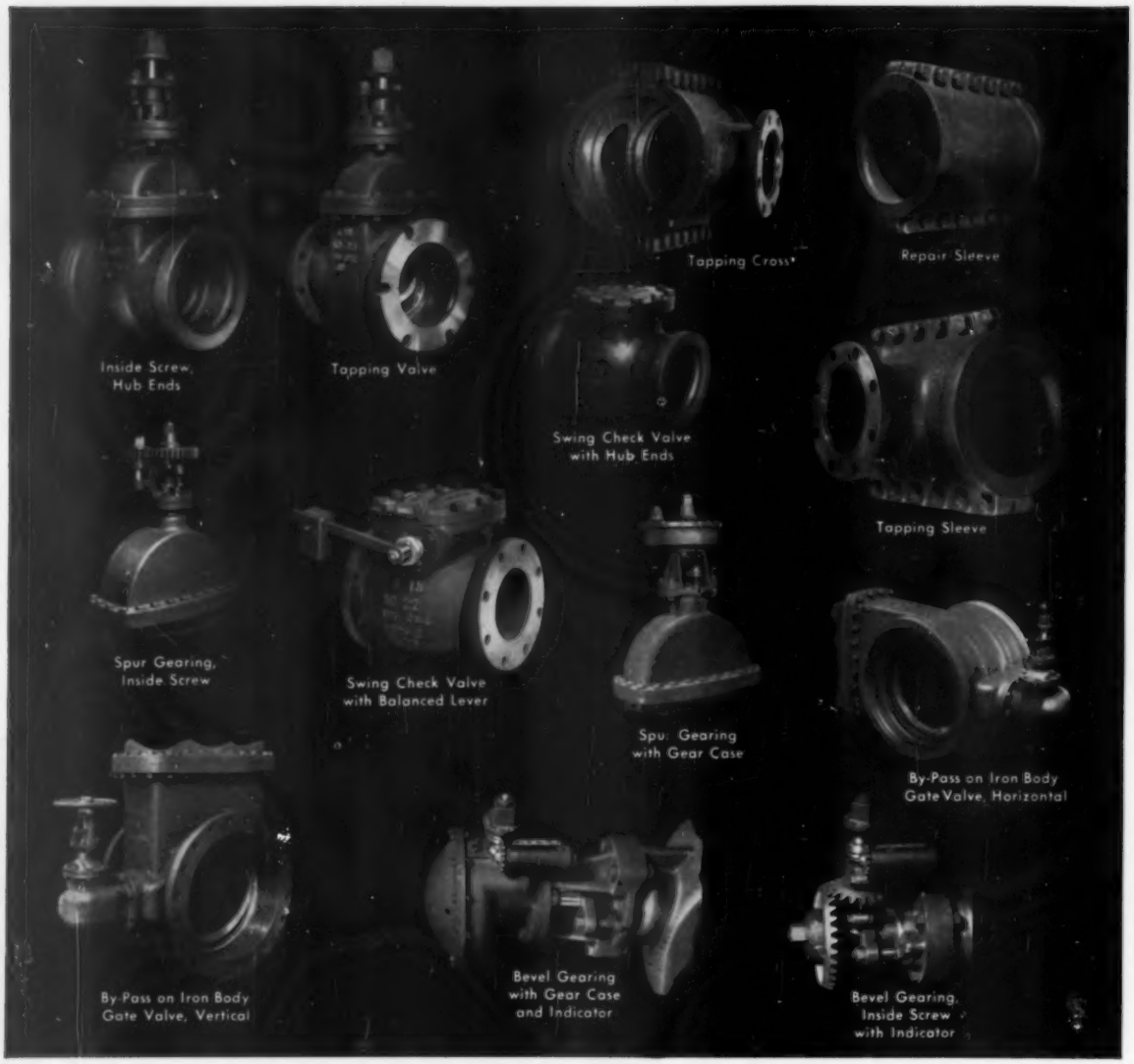
Advanced Design

AMERICAN METERS

American Meters are noted for their simplicity of design. This model consists of a simple, waterproof register box, a disc and chamber unit, frost bottom and gear train. Each of these is easy to disassemble or assemble. Fewer parts permit more rugged parts resulting in trouble-free operation year after year. Simplicity of design reduces parts inventory and lowers maintenance costs. If you are looking for meter simplicity, extreme accuracy and dependability . . . Buy American.

BUFFALO METER CO.

2909 Main Street, Buffalo 14, N. Y.


Inside Screw, Hub Ends
Tapping Valve
Tapping Cross
Repair Sleeve
Swing Check Valve with Hub Ends
Tapping Sleeve
Spur Gearing, Inside Screw
Swing Check Valve with Balanced Lever
Spur Gearing with Gear Case
By-Pass on Iron Body Gate Valve, Horizontal
By-Pass on Iron Body Gate Valve, Vertical
Bevel Gearing with Gear Case and Indicator
Bevel Gearing, Inside Screw with Indicator

DARLINGS...good for YOUR system

TRADE DARLING MARK

THIS composite picture gives you a rough idea of the broad range of Darling valves and allied products engineered for water distribution systems. What you cannot see here, naturally, is the unexcelled Darling quality—carefully controlled from Darling's own foundry all the way through final assembly and test. Nor can you "picture" performance advantages such as offered only by Darling's fully revolving double disc gate valve principle. For items such as shown here . . . and Darling's revolutionary B-50-B hydrants . . . it will pay you to check with Darling.

DARLING VALVE & MANUFACTURING CO.

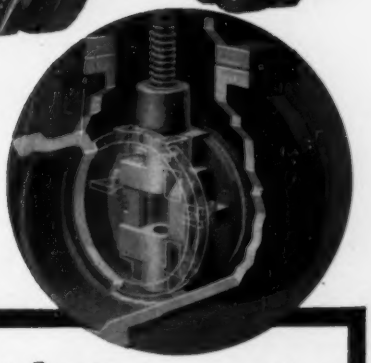
Williamsport 11, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

MUELLER®

CUT-IN SLEEVE AND VALVE GIVES ADDED CONTROL—

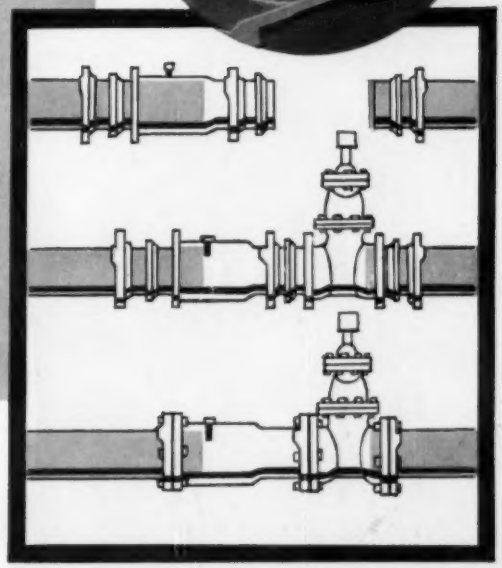
at low cost!



You can add needed control valves on 4", 6", 8", 10" and 12" cast iron mains quickly, easily and at low cost with the Mueller Cut-In Sleeve and Valve.

Both the sleeve and valve are equipped with mechanical joint to give permanent connections in a minimum of time. A Cut-In Sleeve and Valve of a nominal size will fit all classes of pipe in that size range, by using a specific type of end gasket. A variety of types of end gaskets are available for all classes of pipe.

The Mueller Cut-In Valve is available with conventional packing or "O" ring stem seals. The exclusive Mueller four-point disc wedging mechanism exerts seating pressure near the perimeter of the discs – prevents disc deflection and assures positive shut-offs. Consult your Mueller W-96 Catalog, your Mueller Representative, or write direct for complete information.



MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

Water is vital...

Badger meters conserve it better!

IN only one year, more than *26-million tons of paper* are required to fill the needs of the nation . . . to help business operate, to serve personal needs, to bring your daily newspaper to your door. Yet it takes *more water than wood* to produce this paper.

The Badger water meters used in America help save water for this vital need . . . measure water accurately for homes and industry . . . provide a precise check of water usage and waste. And they make certain that users pay fairly for the water consumed . . . help make water departments self-supporting.

As a result of their superior performance through the years, Badger meters are the favorites of waterworks men everywhere... famous as the meters that save water, work and money.

Badger Water Meters

Badger Meter Mfg. Co.
Milwaukee 45, Wisconsin

"Measuring the water of the world for 50 years"

THREE HORTON WATERSPHEROIDS

help meet Peak Demands at Elmhurst, Chicago suburb

West Tank

South Tank

North Tank

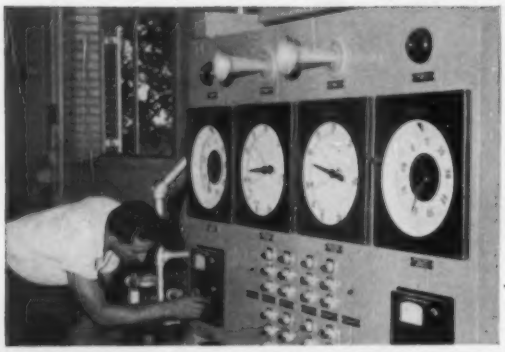
Distributed elevated water storage has helped Elmhurst, Illinois, solve extreme variations in distribution pressures during peak load periods. Today, water is pumped to the three 500,000-gal. Horton Waterspheroids® during off peak periods . . . when demand skyrockets, the elevated water, under dependable gravity pressure, bolsters sagging pressures.

Waterspheroids, a striking new CB&I design for elevated storage tanks, are built in sizes to 500,000 gals. Write our nearest office for further information.

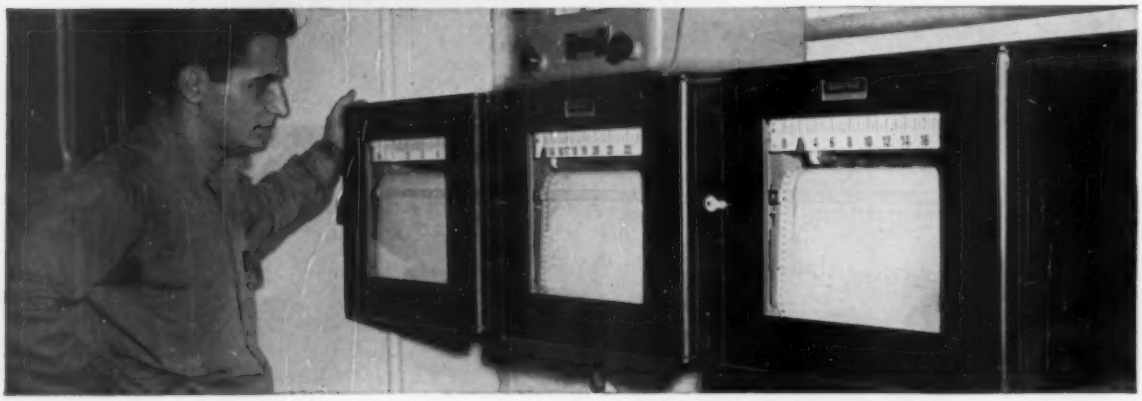
CBI

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.



Incinerator operation at a glance—at Philadelphia's Bartram Plant, ElectroniK instruments in the furnace room (at left) automatically control burners, fans and louvres . . . and (below) tell Superintendent J. Faraldo exactly what values of smoke density and temperatures are being maintained.



New Philadelphia incinerator plants maintain efficiency with *ElectroniK* instruments

The most modern of control techniques are incorporated in the group of new incinerators, ordered as an important part of Philadelphia's $6½ million waste disposal campaign. The Monohearth units, made by Nichols Engineering and Research Corp., are equipped with *ElectroniK* instruments that help to make operation highly automatic and efficient.

In the furnace room, operators have instant control over each variable essential to smokeless, odorless combustion.

ElectroniK instruments indicate smoke density and temperatures in stacks and combustion chambers, regulate furnaces within desired limits of operation. They automatically shut down forced-draft fans, light up auxiliary oil burners, open and close overfire louvres, and turn on water sprays in the fly ash eliminator. Whenever smoke density or temperatures exceed preset limits, the instruments actuate alarms to notify the operator. The plant superintendent, too, can see furnace operation at a glance, by means of other *ElectroniK* instruments in the plant office, which give him easily-read, continuous records of critical temperatures and smoke densities.

When you plan new incinerators or other expansion of waste disposal facilities, have your city engineer or consulting engineer call Honeywell before plans and specifications reach the final stage. Your local Honeywell sales engineer is as near as your phone.

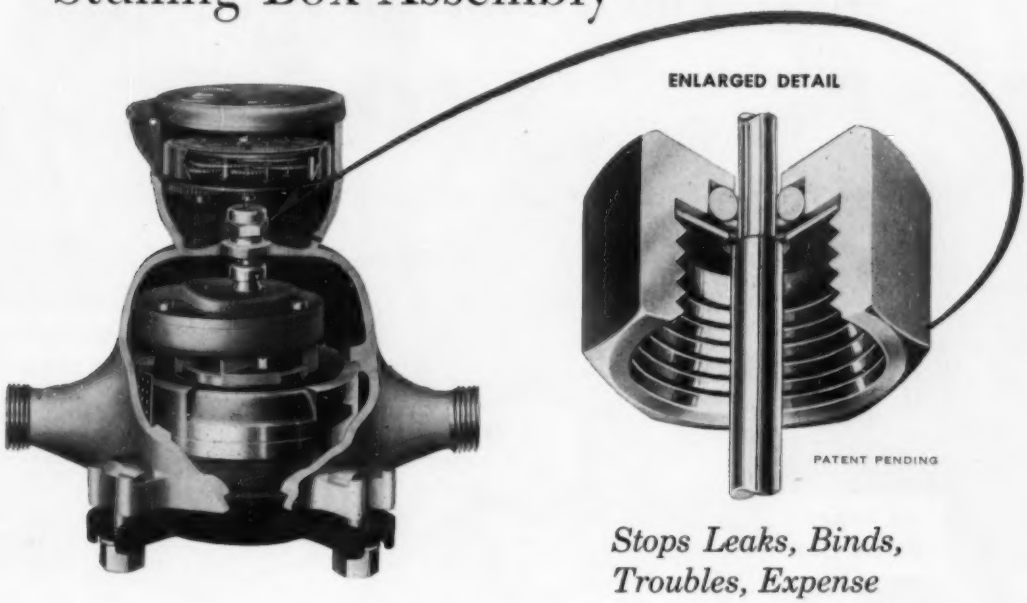
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

The Rockwell "O" -Ring Stuffing Box Assembly



Stops Leaks, Binds, Troubles, Expense

The Greatest Single Advance In Water Meter Construction In Years

Here's another outstanding development from Rockwell Research. It's a sure cure for all the headaches that go with meter stuffing box maintenance. Perfected four years ago, this Rockwell "O"-Ring Stuffing Box assembly has now been thoroughly field tested. *It won't leak; can't bind!* Meters with this construction run more freely, stay accurate longer. Worn spindles are a thing of the past.

Now *all* Rockwell water meters make use of this *exclusive* "O"-Ring design upon which patent application has been made. There's no extra cost for this construction, but a lot of extra satisfaction and value. Ask your Rockwell representative to demonstrate. And be sure to inquire about the use of "O"-Ring stuffing box nuts as interchangeable replacements for stuffing box assemblies in earlier model Rockwell meters.

ROCKWELL MANUFACTURING COMPANY

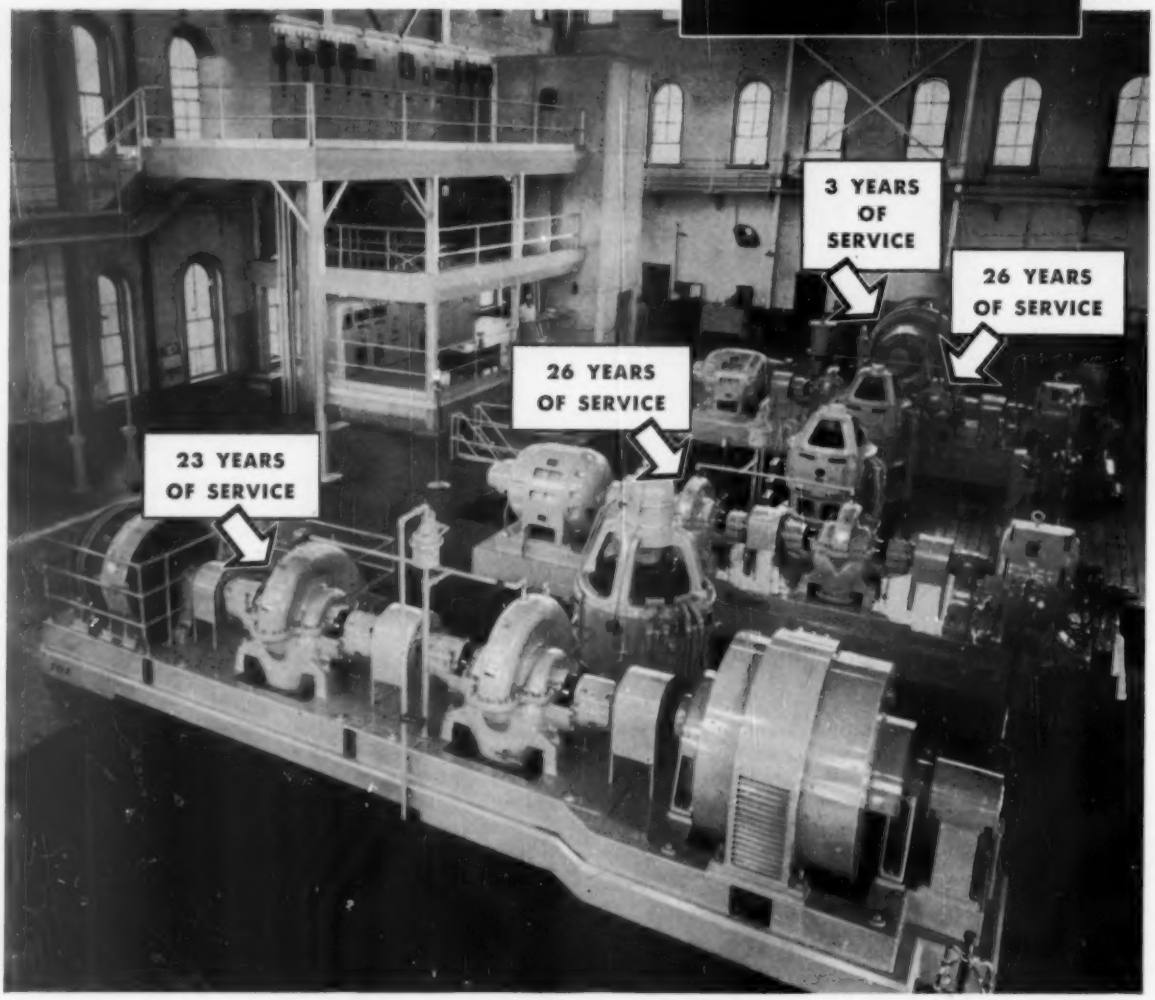
PITTSBURGH 8, PA. Atlanta Boston Charlotte Chicago Dallas Denver Houston Los Angeles Midland, Tex. New Orleans New York N. Kansas City Philadelphia Pittsburgh San Francisco Seattle Shreveport Tulsa In Canada: Rockwell Manufacturing Company of Canada, Ltd., Toronto, Ontario

ROCKWELL WATER METERS

A Size and Type For Every Kind of Service

Nashville goes to 100 mgd with

DE LAVAL
CENTRIFUGAL PUMPS



The years of service shown on these De Laval centrifugal pumps tell their own story of dependability and progress. By revising its facilities, the George Reyer pumping station in Nashville has boosted its pumping capacity to 100 million gallons per day.

The De Laval pumps play an integral part in this more efficient operation. For example, the newest De Laval unit handles 40 million gallons per day.

In fact, 80% of all cities in the United States, with a population of 100,000 or over, use De Laval centrifugal pumps. Capacities of De Laval centrifugal water works pumps range from 100 thousand to 100 million gallons per day. Write for your copy of new De Laval Bulletin 824.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY

824 Nottingham Way, Trenton 2, New Jersey

DL 306

Cuts digging day to 3 hours with powerful ½-yard Hydro-Trencher

Here the Hydro-Trencher digs a ditch for a new sewer line. Hydraulic stabilizer blade also acts as a backfiller blade. By simply turning the bucket around you can convert the trencher to a swing loader. Hydraulic trip loading bucket is also available.

This Oliver 88WT Hydro-Trencher is working on a city sewer project—locating a manhole 8-feet deep through a 2½ by 5-foot street opening.

By hand this is a full day's work for three men. The Hydro-Trencher cut the time to three hours! Working in cramped quarters is duck soup for the 88WT. Powerful hydraulic down pressure, 170° bucket rotation and maneuverable, dual-circuit control let you dig in the most inaccessible places... work delicately around pipes, foundations without fear of damage.

With the 88WT you can slice through rocky soil, roots, hard Clay—dig all the way to 12 feet. The two complete hydraulic systems on the Hydro-Trencher give you unbelievable control—let you perform any two operations at once without loss of pressure.

Owners of Hydro-Trenchers enthusiastically report savings in time and money on many jobs formerly requiring hand labor or larger equipment. Get the low-down on the most profitable, maneuverable trencher in the field—the Oliver 88WT. See your Oliver Industrial Distributor for a demonstration.

THE OLIVER CORPORATION

400 West Madison Street, Chicago 6, Illinois

OLIVER

a complete line of industrial wheel and crawler tractors

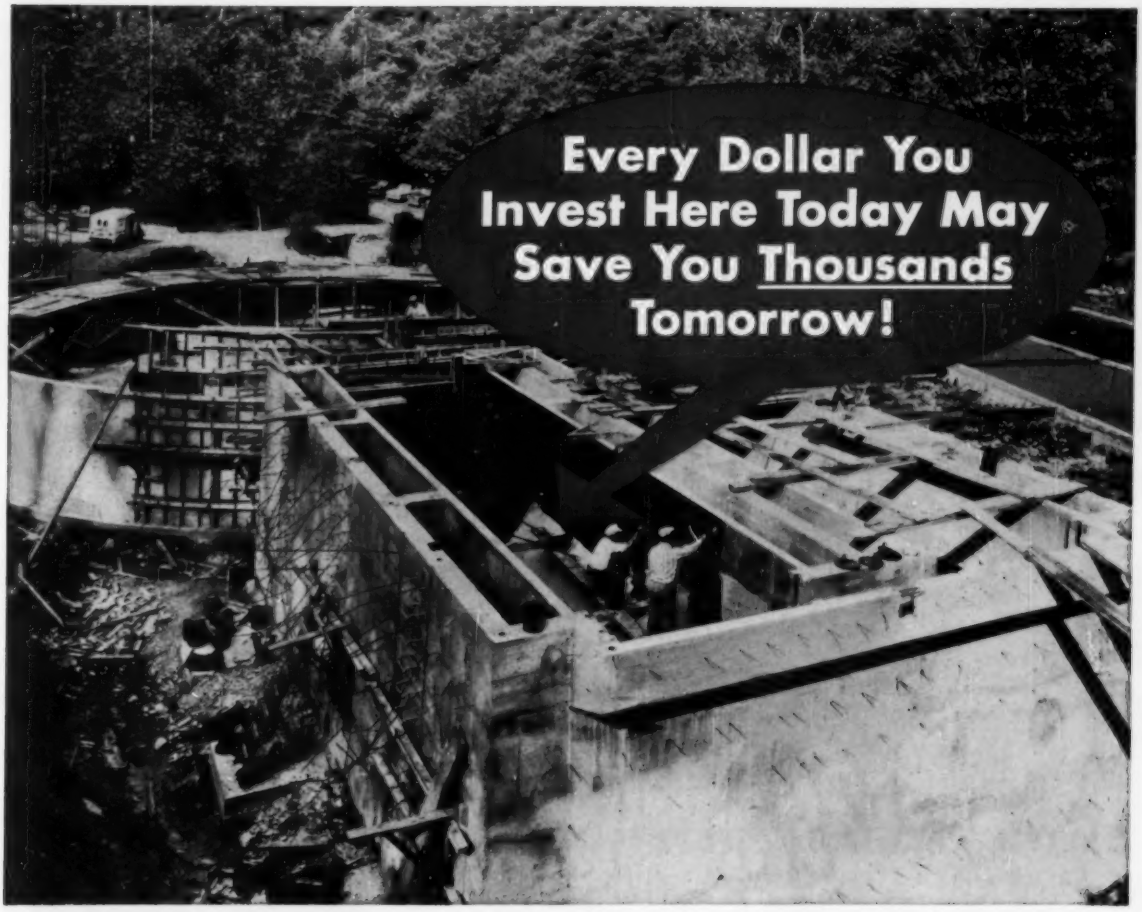
The best water meter you can buy is

HERSEY

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
SAN FRANCISCO — LOS ANGELES



MAINTAINING and replacing sewage disposal equipment is too costly today to gamble on half-way corrosion control methods. And the only practical way to be *sure* of adequate protection is through the use of durable, heavy-duty coatings.

Pitt Chem Coal Tar Coatings fill that bill perfectly. In plant after plant, sewage engineers have seen how these tough, impervious coatings protect iron, steel and concrete against severest sewage corrosion. They can show you how easy they are to apply, by roller, spray or brush. And they can show you how *economical* they are, compared to the "on-again-off-again" protection of less durable coatings.

Our files are full of case histories on the use of *Pitt Chem* Coatings to solve sewage corrosion problems. Call for a *Pitt Chem* man to discuss them with you . . . and to show you how to add years of life to the equipment of *your* plant.

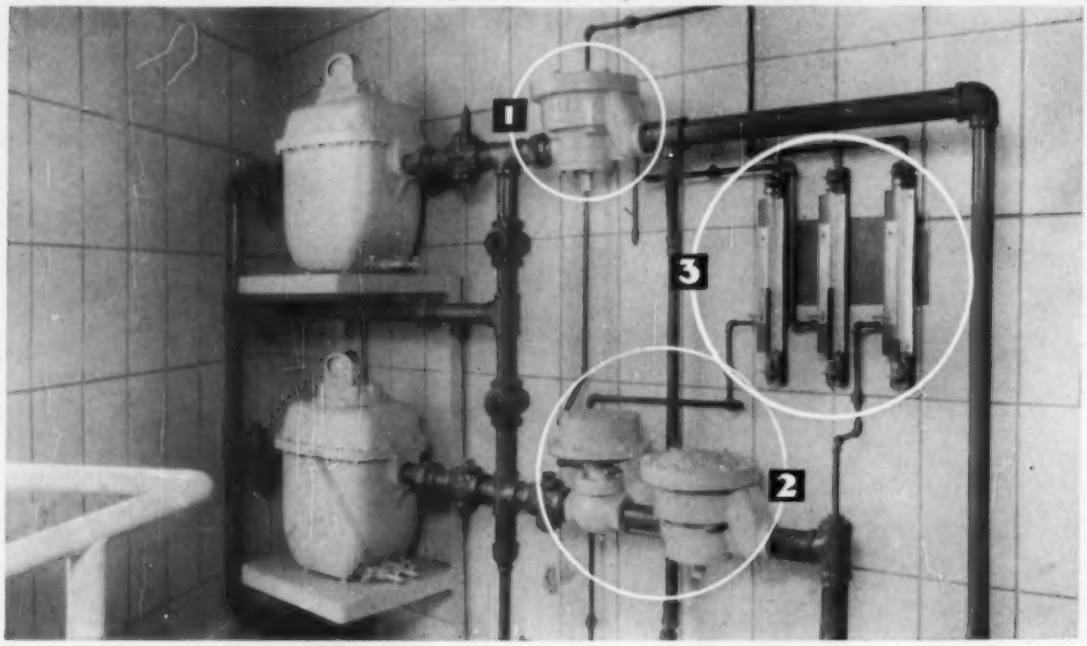
Typical Places Where PITT CHEM® Can Safeguard Your Sewage Plant Investment

- ★ Concrete Surfaces
- ★ Concrete Pipe
- ★ Digestor Dome Interiors
- ★ Structural Steel Parts
- ★ Trickling Filters
- ★ Sludge Drying Beds
- ★ Steel Pipe
- ★ Settling Tanks

W&D 5884

COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

PFT Gas Safety Equipment in the Control Building at the new Morris plant. See description below.



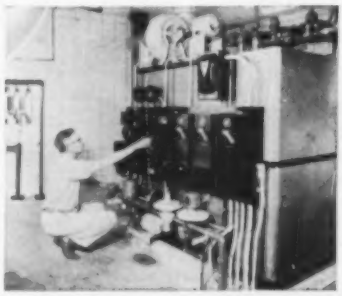
At Morris, Illinois...

A new plant equips for maximum protection

WITH PFT GAS SAFETY EQUIPMENT

The modern primary sewage treatment plant shown here began operations at Morris in March, 1955. Designed for a population of 9,600, it incorporates many features of "Controlled Digestion" in addition to a complete PFT gas safety system! Among the safety equipment items are:

(1) *PFT Flame Trap*—a heavy cast iron housing with aluminum flame arrester element prevents passage of flame. A thermal valve closes automatically at critical temperatures.



Plant Superintendent G. B. Reagen checks operation of the PFT #250 Heater & Heat Exchanger.

(2) *PFT Pressure Relief with Flame Trap*—the same flame trap features plus a pressure relief with diaphragm control. Maintains a safe, constant pressure at the digester and in the gas distribution system.

(3) *PFT Gas Pressure Gauge*—a 3 scale gauge indicates the pressure in various parts of the gas piping system. Top of gauge connects to vent manifold with flame checks.

PFT Drip Traps—four 2 qt. traps provide safe removal of condensate formed by warm gas passing through cooler piping.

Waste Gas Burner—an effective device that safely burns off all excess gas and prevents odor nuisance.

Additional equipment at the Morris plant includes: *PFT Floating Cover* for the 40′ digester; *PFT Heater & Heat Exchanger; PFT Supernatant Selector and Gauge* unit.

Morris' city officials and consulting engineers have created a fine plant that serves efficiently and economically. PFT is proud to have contributed its share to another modern sewage system.

Left, PFT Floating Cover on the 40′ digester. PFT prefabricated insulated roofing reduces digester heat losses.

Design of plant by / *Baxter & Woodman, Civil & Sanitary Engineers, Crystal Lake, Illinois*

waste treatment equipment
exclusively since 1893

P.F.T.

PACIFIC FLUSH TANK CO.
4241 Ravenswood Avenue
Chicago 13, Illinois

PORT CHESTER, N. Y. • SAN MATEO, CALIF • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

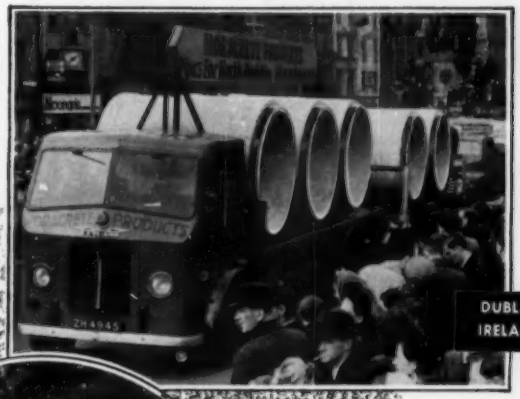
Wherever sewer and drain lines are being built for long, trouble-free service

YOU'LL FIND

TYLOX

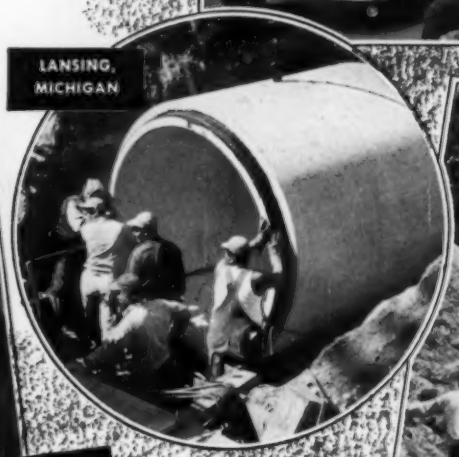
flexible RUBBER GASKETS

on the job . . .



DUBLIN, IRELAND

MIAMI, FLORIDA



LANSING, MICHIGAN

BOULDER, COLORADO

SASOLBURG, SOUTH AFRICA

In America, and all over the world, engineers and contractors call on TYLOX flexible RUBBER GASKETS to prevent infiltration at pipe joints . . . to eliminate costly trench-work delays and speed pipe-laying . . . to defeat corrosion and insure water-tight, maintenance-free joints for the "life of the pipe itself". That's why TYLOX Gaskets were specified for the big pipe projects shown here . . . why they are specified for most waste disposal projects . . . everywhere!

WRITE TODAY for the facts on TYLOX, the *only* flexible pipe-joint meeting requirements of engineers, contractors and taxpayers alike. Read the facts, and take advantage of this champion of pipe joints by specifying "TYLOX RUBBER JOINTS" on your next job.

THE ONLY PERMANENTLY TIGHT LINES ARE LAID WITH RUBBER JOINTS

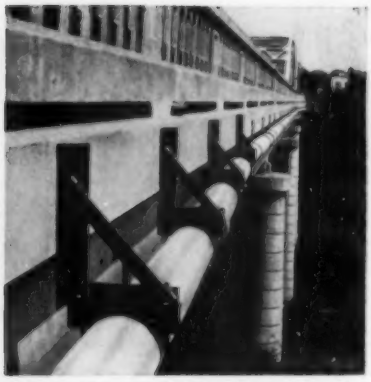
5018

HAMILTON KENT MANUFACTURING COMPANY

KENT, OHIO

427 West Grant St. Orchard 3-9555

In the South! Suspended from a bridge in Tennessee, "Century" Asbestos-Cement Pipe serves ideally because of its light weight and inherently rugged construction. Made in convenient 13′ lengths, this pipe can be attached to bridge structures with a minimum of time and labor, and be readily cut on the job.



Absorbs vibration. "Century" Pipe installations are designed to "roll with the punch." Pipe ends are separated and "float" in rubber gaskets within the asbestos-cement couplings. Vibration of bridge traffic is absorbed by the gaskets and localized to individual pipe sections.

In the West! This is part of a 13-mile installation of "Century" Pipe near Tacoma, Washington. Non-metallic, this pipe can't corrode or tuberculate.

Throughout the Nation, "Century"® Pipe Holds Pumping Costs in Line

"Century" Asbestos-Cement Pipe is winning enthusiastic acceptance in tax-conscious communities across the country, and the reasons are plain. Here is pipe that will carry its rated flow at normal pressure permanently, keeping pumping costs low. "Century" Pipe is made of asbestos fiber and portland cement. It is non-tuberculating, immune to electrolysis, corrosion-proof. Because of its light weight, it is easy to assemble, easy to install. Meets the A.W.W.A., A.S.T.M. and Federal specifications for asbestos-cement pipe.

Free Booklet—"Mains Without Maintenance" gives valuable specifications and reference data for "Century" Pipe. Write for it today.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

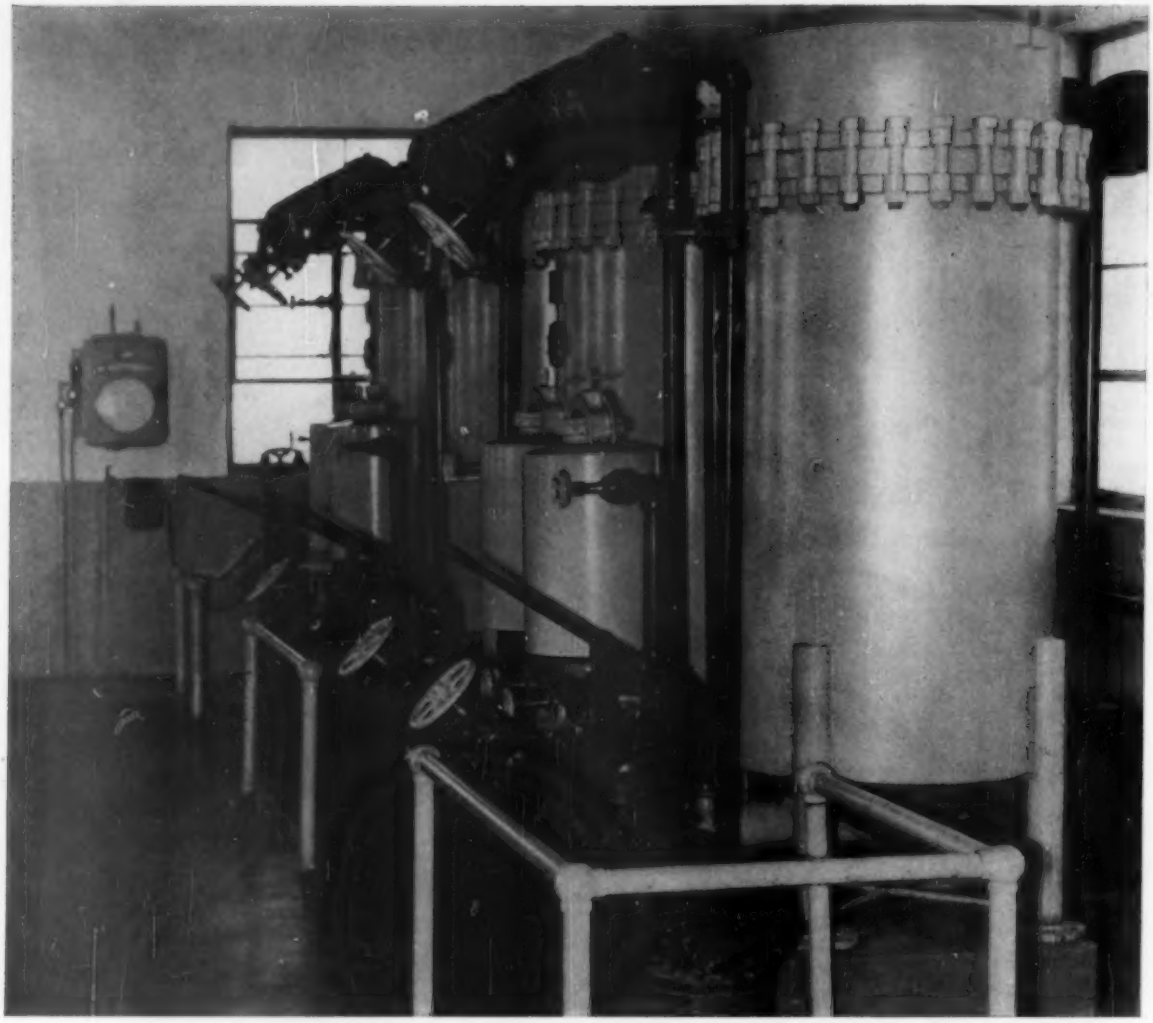
K&M best in asbestos®

Here's how users feel about F&P Chlorination

Mr. Marshall Houghn, Assistant Superintendent in charge of the City Water Division Plant in Columbus, Ohio is one of hundreds of satisfied users of Fischer & Porter Chlorinators. No other chlorinator has gained so many friends so fast. No other chlorinator has proven itself by delivering continuous satisfactory service, year in and year out, with the lowest maintenance costs ever recorded. Write now for information on the complete F & P line of water and sewage chlorination equipment. A postcard will do. No obligation, of course. Fischer & Porter Co. 116 Fischer Road, Hatboro, Pa.

FP

LA1055



PROPORTIONEERS INC. DIATOMITE FILTERS at Tupper Lake, N. Y., which use...

ALOXITE® tubes for most efficient service

Water supply for the town of Tupper Lake, N. Y., is filtered by the diatomite filters shown above. Manufactured by Proportioneers Inc. of Providence, R. I., they use ALOXITE® aluminum oxide porous tubes as the support septa.

These filters have demonstrated that ALOXITE tube septa are highly economical, and give consistently satisfactory performance. The reasons for their superiority in diatomite filtering stem from many inherent advantages. For example, a high percentage of their total area is pore area. Pre-coat builds up evenly on their uniform structure. Backwash is effective and accomplished with a high degree of uniformity. ALOXITE septa alone will even give partially effective emergency filtration. And they resist acids, which permits cleaning of units clogged by iron and other materials.

This informative 56 page booklet describes porous media for all fields of filtration and diffusion. Write us for your free copy today.

CARBORUNDUM

Registered Trade Mark

Dept. X16, Refractories Division, Perth Amboy, N. J.

DRY HTH®

. . . the best solution for all water treatment problems

When it comes to water treatment, nothing equals HTH for convenience, effectiveness and efficiency.

As a dependable *rated* source of chlorine, HTH is the best product of its kind. It contains 70% available chlorine. It's dry, granular, non-dusty, fast dissolving. It's clean and white . . . yields clear solutions. HTH is stable, too, and you'll find it easy to store without extra care or precautions on your part.

Use HTH in tablet form if you require a slower dissolving source of chlorine—one which will maintain chlorine residual over a long period of time (for example, sanitizing new pipe lines).

Both HTH Granular and HTH Tablets are available in 100-lb. drums and in cases of small-size cans. For more detailed information, just call your HTH supply house or mail the coupon below.

3506

MATHIESON

OLIN MATHIESON CHEMICAL CORPORATION
Industrial Chemicals Division
Baltimore 3, Maryland

Please send complete information on HTH for water treatment applications.

Name_____

Company_____

Adddress_____

_____

Using Aqua Nuchar

activated carbon has to be a flexible operation. If taste and odors in raw water increase due to seasonal conditions the dosage must be stepped up. Likewise when the amounts of objectionable odor fall off to a normal level, the dosage requirements of Aqua Nuchar activated carbon decrease. Constant checking by Threshold Odor Tests assures water plant operators of

Refreshing Palatable Water

Modern methods of handling activated carbon make it possible to store and feed Aqua Nuchar and still keep your plant clean. Let us tell you about recent advancements in slurry storage and feeding of Aqua Nuchar activated carbon.

NUCHAR

industrial CHEMICAL SALES
division west virginia pulp and paper company

NEW YORK CENTRAL BUILDING, 230 PARK AVE., NEW YORK 17, N. Y.

PHILA. NAT'L BANK BLDG., BROAD & CHESTNUT STS., PHILA. 7, PA.

PURE OIL BUILDING, 35 E. WACKER DRIVE, CHICAGO 1, ILL.

2775 S. MORELAND BOULEVARD, CLEVELAND 20, OHIO

In Cleveland's Sewage Disposal Improvement Program . . . WROUGHT IRON PIPE stands guard against corrosive attack

There's plenty of evidence in Cleveland's Southerly Sewage Disposal Plant improvement program to show that the City's planners put a great deal of emphasis on economy of operation. One outstanding example is the extensive use of wrought iron pipe. More than 115 tons of this corrosion-resistant material was installed in the following services:

Sludge digestion and elutrition tank piping
Cold water lines—1" to 2½"
Downspouts and leaders
All heating piping
Handrailings
Blower lube oil piping
Perforated pipe diffusers
Expansion tank piping
Air piping
Air intake piping
Diesel oil piping
Exhaust gas piping

The entire program is supervised by City of Cleveland's Director of Public Utilities, Emil J. Crown, and is under the direction of Commissioner of Engineering, G. W. Hamlin, and Commissioner of Division of Sewage Disposal, G. E. Flowers.

The corrosion hazard in each of these services is well recognized. Many engineers, from all sections of the country, can certify how effective wrought iron pipe is in combating the condition, and providing long, economical life. Our bulletin, *Wrought Iron for Sewage Treatment and Disposal Installations*, discusses these, and other services, and documents wrought iron pipe's outstanding performance in each.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N. Y.

Available in Canada and throughout the world.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

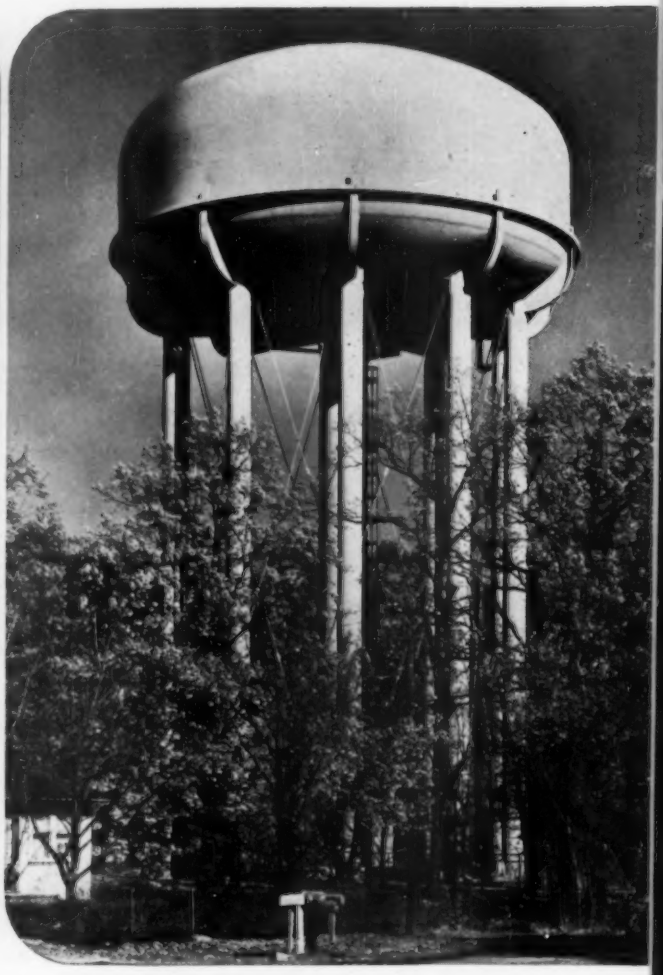
WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY STEEL PRODUCTS

FORT WAYNE, IND. *made it* **two**

for better water service throughout the community



PITTSBURGH-DES MOINES *Elevated Steel Tanks*

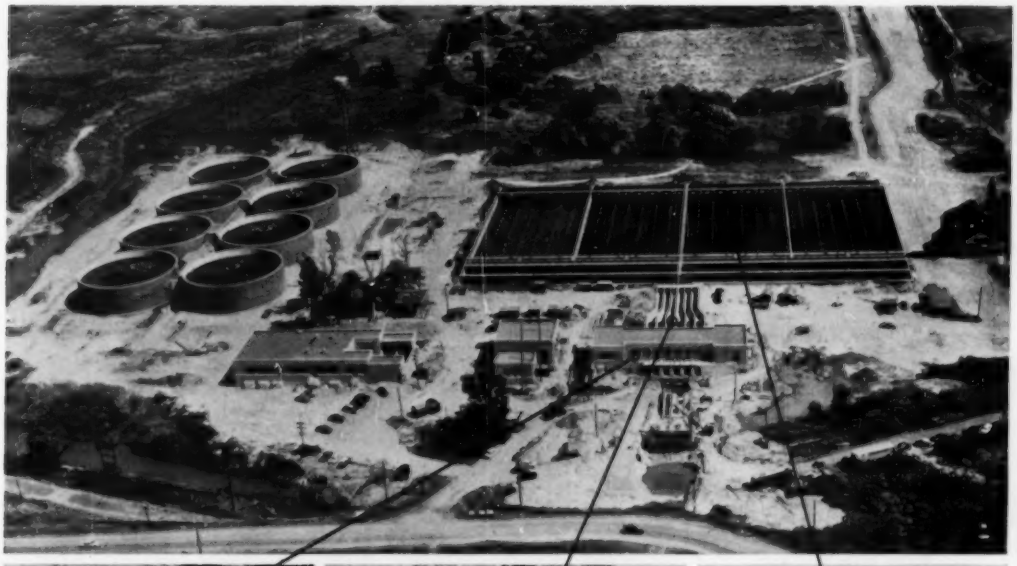
Two strategically-located million-gallon P-DM Radial Cone Tanks provide balanced water supply for Fort Wayne, with completely dependable storage at all times. This and other Pittsburgh-Des Moines Elevated Steel Tank types are detailed in new catalog just off the press. Write for your copy!

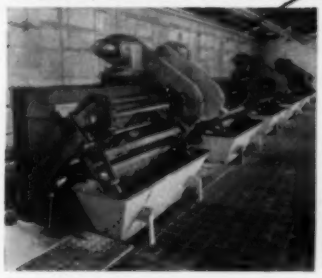
PITTSBURGH · DES MOINES STEEL Company

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25).....3416 Neville Island
NEWARK (2).....217 Industrial Office Bldg.
CHICAGO (3).....1220 First Natl. Bank Bldg.
LOS ANGELES (48).....6399 Wilshire Blvd.
DES MOINES (8).....917 Tuttle Street
DALLAS (1).....1221 Praetorian Bldg.
SEATTLE.....623 Alviso Road





Six Link-Belt inclined bar screens, each with eight rakes, discharge screenings onto steel belt conveyor.

Sewage from grit and screen building flows into six grit channels, where grit settles and is removed by L-B grit collectors and washing-dewatering screw conveyors.

Primary settling tanks use Link-Belt longitudinal and cross collectors, scum skimmers and drives.

Philadelphia's Southwest Sewage Works demonstrates

how to keep treatment capacity ahead of population growth

FORESIGHT was a key element in planning this new Philadelphia sewage plant. It had to provide practical waste treatment for a population of 870,000 — yet be able to serve the estimated 1,200,000 expected by 1970. Working with city engineers, Link-Belt helped supply the efficient screens, grit collectors and sludge collectors to handle 136 mgd.

This $8 million plant is part of Philadelphia's ten-year, $80 million program for the elimination of stream pollution. Link-Belt Straightline Collectors were also chosen for the Northeast Works with a capacity of 125 mgd, completed in 1951 as the first phase in this huge project.

Whether you're concerned with large municipal or small industrial waste treatment . . . or need the finest in modern water purification equipment — count on Link-Belt to provide maximum efficiency at all flow conditions. Our engineers can call on a complete line of equipment . . . will work with you, your chemists and consultants.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

13,941

WITH TRIDENT YOU

MODERNIZE AS YOU REPAIR

. . . at only a fraction of the cost of new meters

It's easy . . . and a proved economy . . . to keep your Trident water meters up to date. Parts made for modern Tridents, embodying every thoroughly tested advancement known to the science of metering, are designed to fit into any Trident water meter of the same size and type . . . no matter how old. Every time you replace worn parts with genuine Trident parts, the meter's ready for many more years of accurate service . . . at only a fraction of the cost of scrap-and-replace programs.

No need to keep complicated stocks of parts for many models. Just keep the latest Trident parts on hand. Reordering and stock control are simple, and your meters never become obsolete. Training service men is easy, too. Not only is the Trident extremely simple and virtually fool-proof, but also your service men need learn only one model.

This 50-year policy of Trident is your best assurance that the meters you buy today will earn maximum revenue for your utility . . . with lowest yearly costs . . . for many years to come.

NEPTUNE METER COMPANY
19 West 50th Street • New York 20, N. Y.

NEPTUNE METERS, LTD.
1430 Lakeshore Road • Toronto 14, Ontario

Branch Offices in Principal American and Canadian Cities

neptune

258

WATER & SEWAGE WORKS

VOL. 103, NO. 1 • A Scranton Gillette Publication • JANUARY, 1956

STEEL PIPE in 40-foot lengths, field welded to form 120-foot sections, jointed with flexible couplings

Water Supply Progress in 1955

A review of developments and trends in the field

by FRANK C. AMSBARY, JR.

Mr. Amsbary, President of the American Water Works Association, and formerly Vice-President of the Northern Illinois Water Corp., Champaign, Ill., recently became Vice-President and General Manager of a sister property, the Long Island Water Corp., Lynbrook, N. Y.

EMERGENCY CHLORINATION became the order of the day in the flood stricken northeast

NEW-TYPE FILTER PLANT employs Dorrco-Aldrich "Peri Filters", a combination up-flow clarifier and annular filter

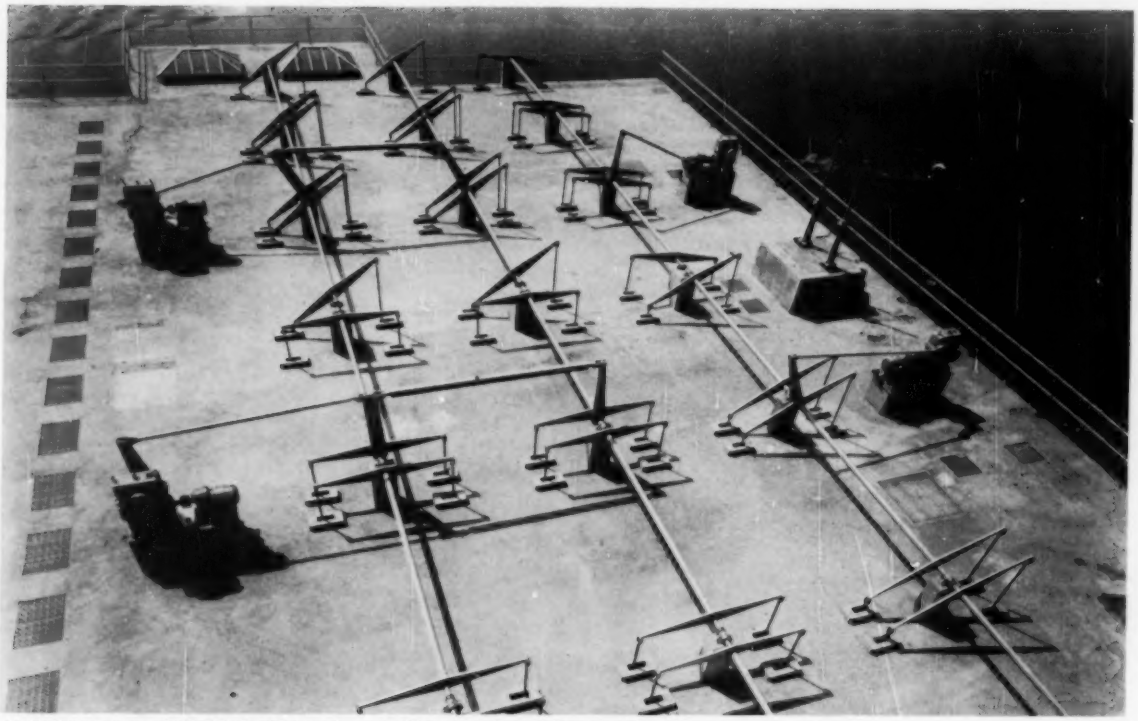
MORE ELEVATED STORAGE for outlying areas during 1955 to improve system pressure and flow characteristics

THE YEAR 1955 was one of the busiest in some time for water utilities throughout the nation. In an attempt to keep up with new subdivisions, with the necessary main extensions and service connections, many utilities found it difficult (in some cases impossible) to keep up with the normal orderly replacement of inadequate supply and distribution mains and reenforcement of other facilities to meet the spiralling demands for water.

New subdivisions being located on the periphery of the community naturally increases the problem of distribution. In many communities this problem is being effectively taken care of by the installation of properly located elevated storage, or ground water reservoirs in conjunction with pumping stations, at less cost than the installation of reenforcing mains through built-up areas. These outlying pumping stations, usually completely automatic in operation, have been found satisfactory.

"Demand Charges" New In Water Service

Further progress was made in the field of "demand charges" for low-load factor water accounts. Most particularly has the demand charge been made in connection with non-conserved water use in air conditioning.

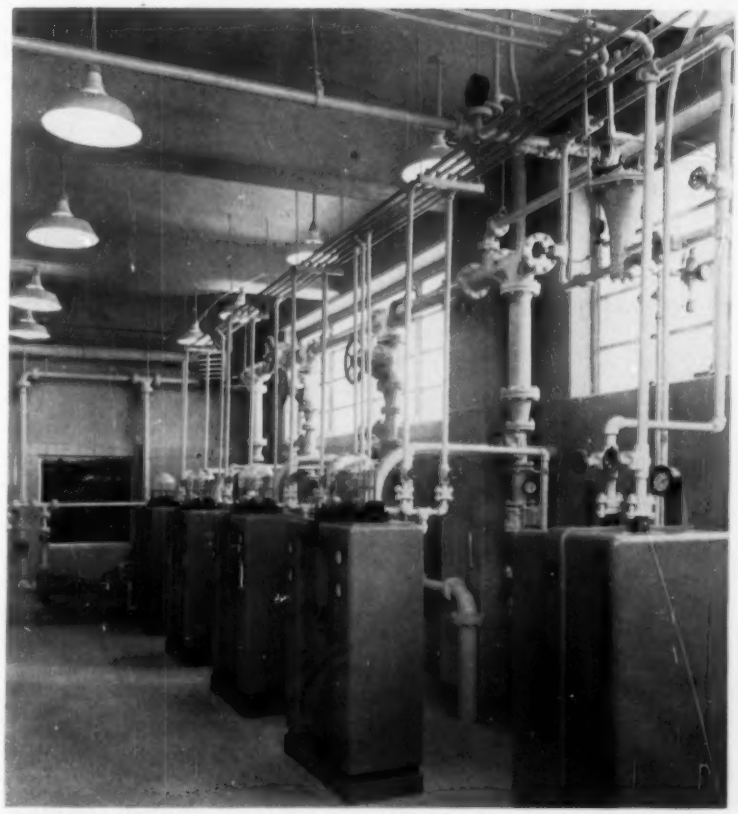


WALKING BEAM FLOCCULATORS at the new filtration plant of Trenton, N. J.

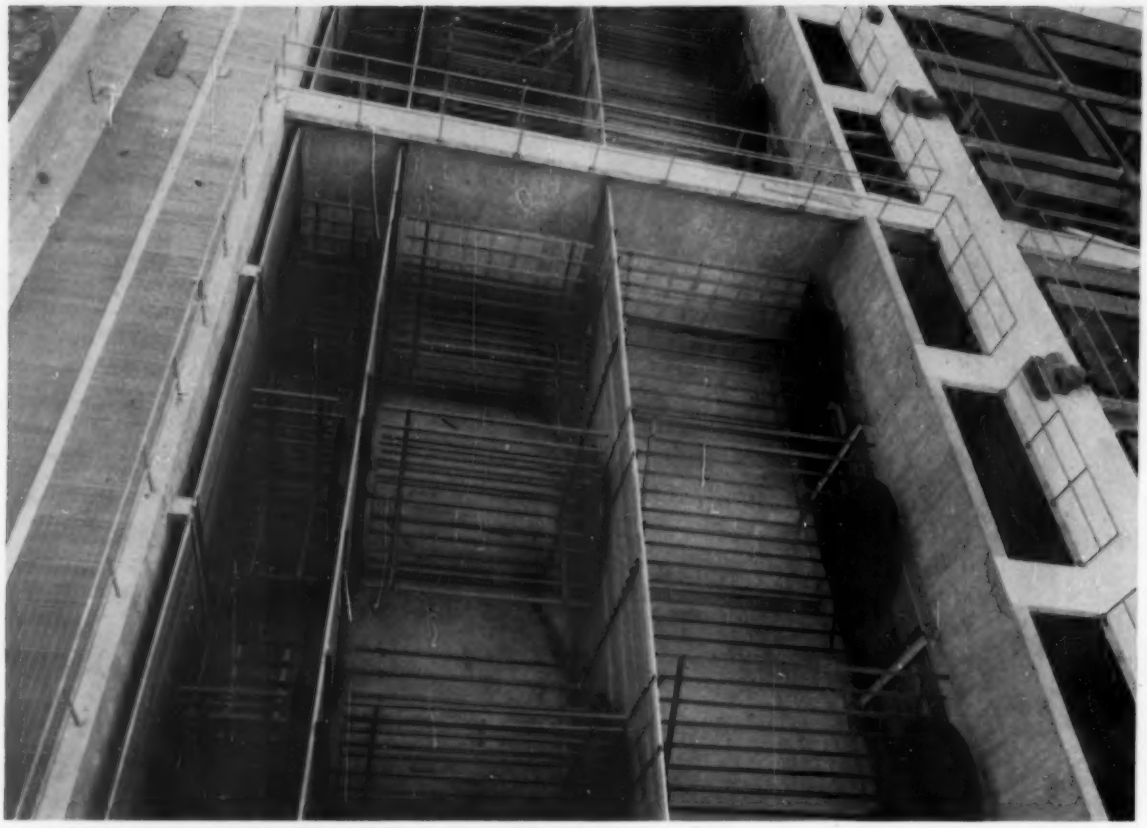
The Missouri Public Service Commission approved a demand charge for non-conserved water use in air conditioning of $40 per ton per year of refrigeration capacity on air cooling systems in the St. Louis County Water Co. area; Atlantic, Iowa, by ordinance approved a demand charge of $10 per year per ton of refrigeration. The $12.50 per ton per year demand charge approved by the Arkansas Public Service Commission for use by the General Water Works Corp. of Pine Bluff, Ark., has been previously reported as probably the first such innovation in water service charges. Northern Illinois Water Corp. filed a rate of $45 per year per ton of refrigeration capacity with the Illinois Commerce Commission for non-conserved water use in air conditioning. The hearings on this petition have been completed, but up to this writing the order has not been issued.

The practice of making demand charges in water service is making progress. Why the water industry has been so slow to recognize the problem of low-load factor accounts, which has long been recognized throughout the electric industry and by Public Service Commissions, and has been compensated for through the use of demand charges, is hard to understand.

A utility must have a certain gross



CHLORINATORS of the new Houston, Tex., filtration plant provide chlorine application at four points



"FLOCTROL" chain-belt units installed in the Fort Wayne, Ind., filtration plant

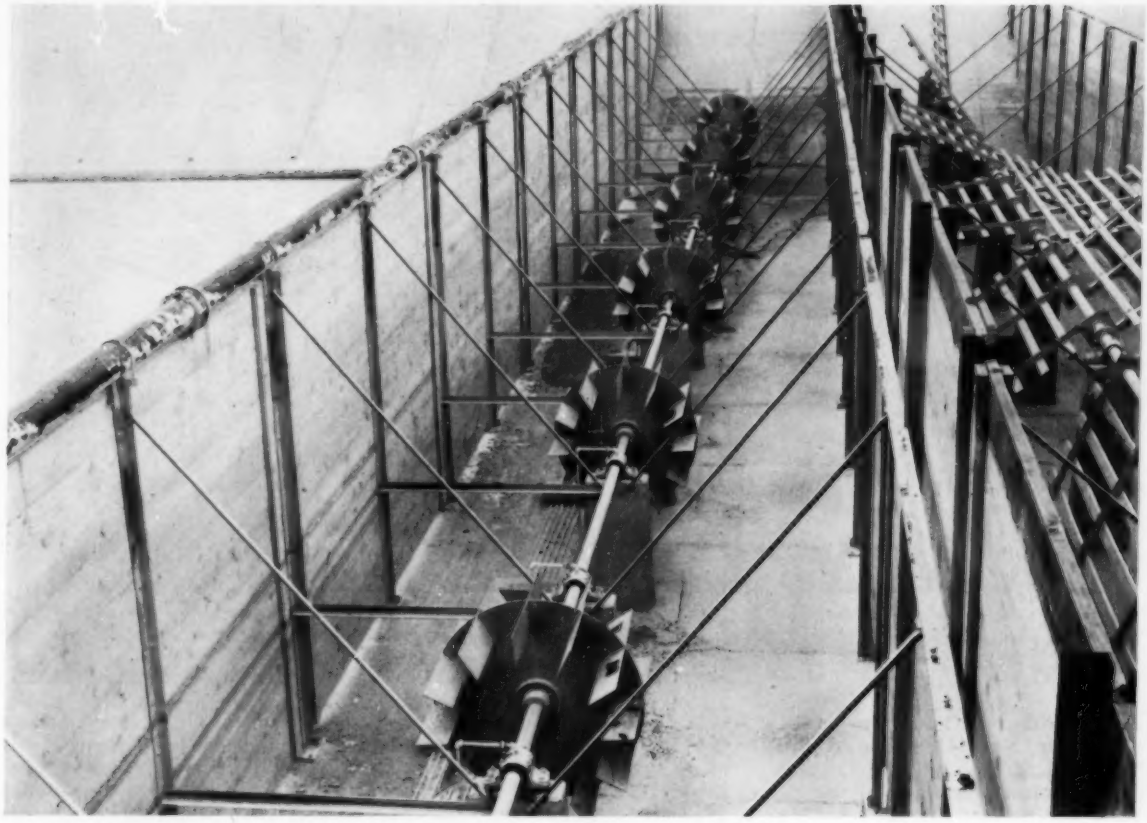
revenue to continue a healthy existence. If this gross revenue is the result of one fixed metered rate schedule, with no recognition of low-load factor users, it is discriminatory. In the 1950 report of the AWWA Committee on water use in air conditioning it recommended that demand charges be applied to non-conserved water use in air conditioning *and other low-load factor accounts.* The AWWA Committee on Water Rates in their report in 1954 recommended demand charges as the proper approach to low-load factor accounts.

Air conditioning load is not the only low-load factor water usage. In sections of the country where climate controls the canning season, a canning factory is a notoriously low-load factor account. A thorough study of each community should be made and every low-load factor user carefully analyzed. Then, to assume that every class of water user is in itself economically self-supporting, demand charges should be instituted.

POROUS PLATE filter bottom of new design employs vitrified tile plate holders and "Aloxite" plates

Water Supply in the Atomic Age

Techniques are being developed for the water industry to take advantage of developments of the Atomic Age. Experimentally, gamma rays from radioactive isotopes have been used successfully to disinfect sewage. Water may be next. It is said that if this proves successful such a treatment may cost less than chlorine.

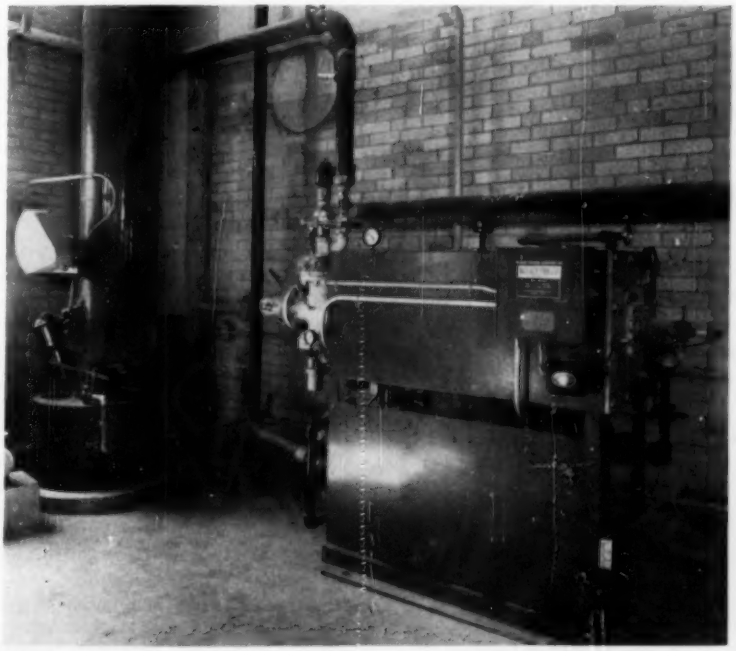


"VERTI-FLOC" Infilco units installed in the St. Louis County Water Company's filtration plant

Putman and Jefferson reported in the British magazine, *Water & Water Engineering*, the successful use of radioactive methods in locating leaks. This method is applicable where the immediate back-filling of the trench is required as new water mains are installed, and test must be made subsequent to backfilling. They have used 24/Na ($NaHCO_3$). It was chosen because:

1. It emits penetrating gamma rays (1.4 and 2.8 MeV).
2. It can be quickly prepared in high specific activity by the irradiation of ready-made 0.5-gram pellets.
3. The tolerance is high in drinking water (8 microcuries per liter).
4. The half-life is conveniently short (1.5 hours), so that radioactive solutions can be allowed to decay before discharge from the main.

These two applications are only an introduction to what may come in this interesting age in which we live.



"CARBALL" recarbonation unit of Walker Process Equipment converts natural gas to CO_2 at Elgin, Ill.

A Look Ahead Imperative

As for the future, the utility that thinks only in terms of 1956, 1957 or

PRESTRESSED concrete pipe by Price of Dayton went into Jacksonville's (Ill.) 23-mile supply line

INSTRUMENTATION, the order of the day in even the smaller water treatment plants. Brown instruments by Minneapolis-Honeywell were installed in the new Valdese, N. C., filtration plant

1958 is going to be left at the rear of the parade. Now is the time to plan for 1975 and begin to build for projected demands for water of the future. The utilities that do not have within their own staffs competent personnel to produce such a plan should lose no time retaining a competent consulting engineer to make the study and submit a report.

After such a report is completed, it should be reviewed periodically and modified, changed, and brought up-to-date to more adequately take care of the changed conditions that could not originally be anticipated.

Here are a few of the basic facts that require solid long-time thinking in planning for the future:

The birth rate is increasing. In 1940 there were a little over 2,000,000 births; in 1954, in excess of 4,000,000.

The death rate is decreasing and comparing this with the increase in births, the population is increasing at both ends of the life span. In 1930 there were 192 births per 100 deaths. In 1954, 316 births per 100 deaths.

Thus, our population as shown by past years and as predicted for the future has and will increase as follows:

1950—152,000,000
1955—165,000,000
1975—221,000,000

The rate of population growth is 1.7 per cent per year.

Not only is the population increasing, but the per capita water usage is also going up. The national average usage per capita per day in 1945 was 125 gallons; in 1950 it was 138 gallons. Predictions for 1955 and the future are: 145 gallons in 1955, 160 gallons by 1965, and 175 gallons per day in 1975.

Now is the time to think big, to talk big, and to act big. The public utility that does not is going to lose out. The public must be sold on a large expansion program. This can be done if they are well informed and if such information is based upon facts and not upon conjecture.

Automation the Order of the Day

Such a program should include automation in every phase of operation possible. Properly thought out design and installation of automatically controlled equipment assures more precise operation than is possible with human control. A machine does not forget or go to sleep. Automation has the further advantage of reducing labor costs. Reports indicate numerous failures of manually operated plants, whereas in its present development automation appears to be free from this complication.

Unfortunately, automation that is already in operation in this country has not been fully reported. Because of this, only general statements can be made, as detailing certain installations might result in no mention of more complex and complete systems in use.

Generally speaking, it is not uncommon to find outlying wells, booster stations, and pumps pumping from surface distribution reservoirs operating entirely automatically. These are operated on pressure or time switches, or both in combination.

More uncommon is the operation of such installations from central dispatching stations. This system has the advantage over the pressure and time switch installation in that from his instruments the dispatcher can anticipate the demands and start the necessary equipment just prior to the time of heavy usage and thus maintain more uniform service.

The only completely automatic pumping station so far publicized is at Falkirk, Scotland. At this plant everything is automatic from the source of supply through high service pumping. Filters are even washed and operated entirely by automation. Yes, automation should definitely be included in the thinking for 1956 and the future.

An Explanation

Your reviewer feels apologetic for the inadequacy of this contribution, which results from the unexpected demands on his time in recent weeks. These demands are the result of change in both position and location, added to a heavy schedule of sectional meeting attendance incident to the AWWA office which he is privileged to hold.

GENERAL VIEW of accounting, billing and collection office, Phoenix Division of Water and Sewers

Modernized Accounting and Service Procedures

by STANFORD I. ROTH

Mr. Roth is Collection Supervisor, Division of Water and Sewers, City of Phoenix, Arizona. In this article he describes how the division modernized its office procedures to cope with the problems presented by a 100 per cent increase in the number of water customers.

NOTHING is quite as effective in stimulating modernization of operating procedures as skyrocketing growth. An excellent example of what can be done is seen in Phoenix, Ari[illegible], where a doubling of the number [illegible] water customers since 1948 has [illegible]sulted not only in economical, streamlined accounting and service procedures, but also in strong emphasis on good customer relations.

In 1952, it was realized that a new approach to these two related problems was the wise course. Therefore, a comprehensive study of policies, procedures, and equipment was undertaken.

The outcome has been establishment of bill collection substations (12 of them in drugstores — the long hours and seven-day operation being a factor in the choice); a unit bookkeeping plan, replacing the conventional ledger system; the reading of meters in even hundreds of cubic feet; a complete revision of the meter reading routes; a Kardex "customer service record"; direct telephone circuits linking the customer contact clerks to any desired unit bookkeeper or customer service record clerk; rate chart billing; and many other modernizations of related procedures.

Customer Satisfaction an Impelling Motive

The methods now in operation in Phoenix reflect today's trend on the part of American utility management

towards placing customer satisfaction high on the list of operational objectives. Most customers having contact with a utility (beyond routine payment of bills) are either urgently in need of service, in the process of moving, annoyed by a supposed overcharge, or under request to rectify a past-due account. In any event, they are almost always on edge or upset to some degree.

It is at this crucial point that a contact clerk immediately able to marshal facts and figures can repair or cement public relations. The philosophy on which the modernization effort has been based is this need for faster, more accurate customer service. To further improve customer relations, a radio dispatch unit in the collecting office expedites transmission of the customer request for service to field representatives.

Office Modernization

Equipment, systems, and services supplied by Remington Rand have been instrumental in achieving many of these goals. The Kardex customer service record is housed in three insulated Multi-Cabinets having a capacity of well over 59,000 service locations (the present list tops 53,000). The file is set up alphabetically by street name, and then by street number. A 6 x 4 in. master card (the permanent office record for the location) provides space for permanent site information, plus turn-on and turn-off notations and posting of the current customer's name.

A traveling "service order" card (normally kept in the pocket with its related master card) has space for four complete service postings. The system enables one to track down, immediately, the status of any given service call, while the customer waits on the phone. One can also tell at a glance, by means of the notations and a system of movable colored signals, whether a location is on or off service, whether or not a meter is in place, and if so how soon it will be due for maintenance replacement. Temporary notations when the service order card is out complete the status record, keeping it immediately current—an important feature from both operational and customer relations viewpoints.

The "unit bookkeeping plan" is a stub accounting system that eliminates the usual ledger sheet. A portion of the customer's printed bill is the office record, and constitutes the accounts receivable. Cycle billing is employed to spread the work load evenly across the month.

Nine clerks are assigned to the job, including a central control bookkeeper and a lead bookkeeper. The former verifies the subsidiary records kept by the unit bookkeepers and maintains a set of master controls; the latter is responsible for supervising the section and completing the monthly cycle balancing of billing districts, within a predetermined work schedule.

Since each unit bookkeeper is responsible for all of her own customer records, the meter books, accounts receivable stubs, and paid stubs are housed in one insulated Safe-Desk per girl. This centralization of records that were once scattered throughout the department, plus the incentive of pride and responsibility inherent in the unit system, have yielded most encouraging results. After only a year the internal accounting control has been strengthened, a uniform basis

UNIT BOOKKEEPER has at a convenient working position the meter books, paid and unpaid bill stubs, and all records for the customers in her group. With drawers closed, the Safe-Desks are fireproof

for evaluation of individual performance has been established, and—in line with the original objective—customer service has been greatly improved.

The Safe-Desks were selected for point-of-use protection of the vital records against fire, including the all-important receivables. These units are efficient work stations, the drawers opening wide, at a comfortable level, to expose all the stubs they contain; yet a quick shove slams them shut should the hazard of fire arise.

Redistricting Proves Boon to Billing

A much-needed part of the modernization program has been redistricting from 31 to 21 billing districts. The Business Services Department of Remington Rand carried out the work, starting with surveys and evaluations and winding up with the cut-over of the records to the new system.

An important feature of the new districting is that a continuous routing plan provides for absorbing future population expansion without disturbing the existing routing system or interrupting revenue. In addition, a smoother working schedule for customer accounting has been established with the elimination of peak loads in meter reading, billing, cost posting, and collection activity.

The study staff from Remington Rand started by verifying the basic records then in use, and carried out map work pertaining to districts and routes; estimated the effect of new districts on revenues; renumbered all affected records, and rearranged meter sheets accordingly; and prepared the street index for existing accounts. This done, they trained the utility employees in the use of the new system, thereby enabling progression to the final stage.

Customer contact desks have been provided for semi-private handling of customers. Clerks have been trained in interviewing techniques, and have learned to make full and rapid use of their links to the unit bookkeepers and customer service records. Each customer's request is given immediate and specialized attention in a more business-like and efficient manner.

As a result, this modernization program has developed more efficient customer service, has improved public relations, and has provided better working facilities. With all of this, it also has reduced operating costs.

Amsbary New Manager of Long Island Water Corp.

Frank C. Amsbary, Jr., president of the American Water Works Association, on November 7 assumed the position of Vice-President and General Manager of the Long Island Water Corporation, which serves water to 19 South Shore communities centering around Lynbrook, N. Y. Active in the field of water supply engineering and management for more than 30 years, Mr. Amsbary came to the Long Island utility from Champaign, Ill., where he had served as Vice-President and Secretary of the Illinois Water Service Co. and Vice-President of the Northern Illinois Water Corp. for many years. Mr. Amsbary is a University of Illinois graduate and a registered professional engineer.

Mr. Amsbary was elevated to the AWWA presidency at the organization's 75th Annual Meeting, held in Chicago last June. Having served the Association as Vice-President, as Director for the Illinois Section, and in a number of other local and national offices, he was also recipient in 1941 of his section's George Warren Fuller Award.

Mr. Amsbary also is a member of the American Society of Civil Engineers, the National Society of Professional Engineers, and numerous other organizations.

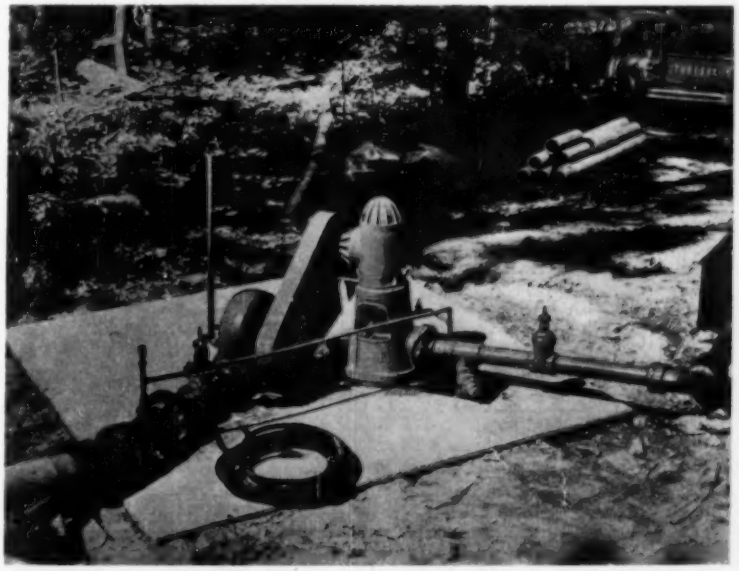
Water Pumped at Marietta, Pa., Without Power Cost

One of the country's most unique community water supply systems delivers 51 million gallons of water per year in the Pennsylvania town of Marietta. The system, installed by the Marietta Gravity Water Company, employs a Deming deep well turbine pump and a Fitz impulse water wheel. In the first 12 months of operation the system was totally free of power and maintenance costs.

The firm draws water from a reservoir located high above the community. Water travels 3,000 feet through a 6-inch Transite pipeline down a 180-foot elevation. At that point it enters the water wheel at about 60 psi. The wheel, in turn, operates a deep well turbine through a right-angle drive.

The turbine delivers 40 gallons per minute. Water drawn from the well, and water passing into the water wheel continue downhill to the company's reservoir at a rate of 140,000 gallons per day. No electricity or gasoline is employed in the operation.

According to Superintendent Henry B. Lenhart, Jr., the system was installed because rugged countryside and dense stands of timber made it too costly to build power lines to the well location.



GRAVITY flow from high reservoir source runs water wheel to pump additional supply from deep well before both streams are run to distribution system at Marietta, Pa.

Head Loss in Butterfly Valves

by H. W. HAMM
Design Engineer, S. Morgan Smith Co., York, Pa.

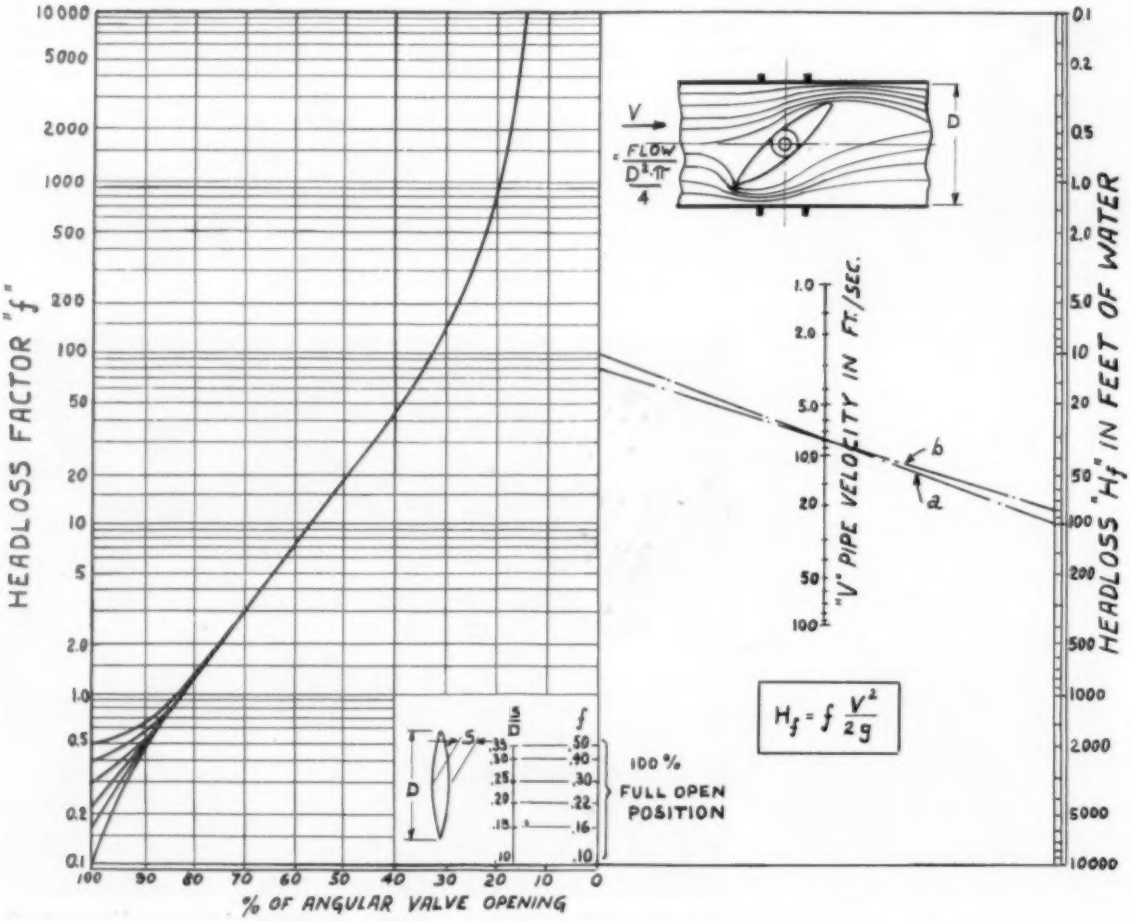
BUTTERFLY valves are frequently used in water supply and in wastes disposal systems because they have the following characteristics:

1. The flange to flange dimensions are small, resulting in space saving.
2. The operating mechanism is simple and rugged, is located outside the valve body, and therefore is easily accessible and not subject to corrosion.
3. The cost is low.

These advantages are to some extent offset by the head loss, which in the full open position is slightly larger than that of other valves, also, by the small amount of leakage which in valves without special seats is inevitable.

Knowledge of the head loss for the full open position is useful. Also, when the valve is used for regulating the head losses at the several intermediate positions is valuable. The accompanying chart gives the head loss factor on the left side and the head loss on the right side. When a valve is equipped with a disc position indicator, the chart can be used to set the valve for any desired flow.

Lines "a" and "b" illustrate use of the chart. Line "a" is for a 24-inch valve in a setting where the static head is 100 feet and the required flow is 25 cubic feet per second. The water velocity in the pipe is 8.0 feet per second, and the pipe is so short that pipeline friction can be neglected. It can be seen that the valve must be 32.5



BUTTERFLY VALVES; relationship between head losses, velocity and disc settings for flow control

per cent open to permit 25 cubic feet per second to pass.

$$H_t = 100 - \frac{8^2}{2g} = 99 \text{ ft.}$$

In this equation, $\frac{8^2}{2g}$ is the velocity head and represents the kinetic energy of the moving water column.

Line "b" represents the same conditions, with the exception that the pipeline friction cannot be neglected because the length of the pipe is 2,000 feet. The head loss for a pipe of 24-inch diameter of this length, manufactured of plate steel, and a water velocity of 8 feet per second is approximately

$$H_p = 0.02 \times \frac{2{,}000}{2} \times \frac{8^2}{2g} = 20 \text{ ft.}$$

With only 100 feet of static head available, the head loss past the valve disc cannot be more than

$$H_t = 100 - 20 - \frac{8^2}{2g} = 79 \text{ ft.}$$

The chart shows that a head loss of 80 feet and a water velocity of 8 feet per second requires an opening position of 34 per cent for the disc.

With the help of the chart it is possible to calibrate the disc position indicator for flow, as well as for disc position, and to thus facilitate flow regulation.

Dan Morse Made V.P. and Gen'l. Mgr. of Indianapolis Water Co.

Daniel P. Morse has been elected vice-president and general manager of the Indianapolis Water Company. He assumed the position on November 1, 1955. From 1946 to 1951 Mr. Morse served as development engineer with the company, then as assistant executive vice-president from April 1954 until elected to his new post. From 1951 to 1954 he was employed in the Engineering and Facilities Planning Department, Eli Lilly & Company, Indianapolis.

Mr. Morse was graduated from the Purdue University school of mechanical engineering in 1939. For the following two years he was employed in the Plant Engineering Department of the Link-Belt Company. From 1941 to 1946 he was connected with the Production and Engineering Departments, Allison Division, General Motors Corp.

He is a member of the American Society of Mechanical Engineers, American Water Works Association, and National Fire Protection Association.

"Dan" is following in the footsteps of his illustrious sire, Howard S. Morse, president and general manager of the Indianapolis Water Company, who put "Dan" to work during his summer vacations at the White River purification plant, at the time in charge of Harry E. Jordan, now executive secretary of AWWA.

Like the greatest men—the greatest truths are usually the easiest to understand and to believe in.

St. Louis Sewer District To Take Over System

The Metropolitan St. Louis Sewer District formally set January 1 as the date when it will assume responsibility for operation and maintenance of all public sewer systems in St. Louis and St. Louis county in a resolution adopted recently by the district's board of trustees.

The district also planned to start on January 1 collection of a sewer service charge from all water customers in the area. The charge, which will be $6 a year for most householders, is being made to provide the district with operating revenue.

The trustees authorized William Q. Kehr, executive director of the district, to draw up agreements with the city and county sewer agencies for lease of sewer maintenance equipment.

"Something tells me that this here new self-winding wrist watch will never outlast this paving breaker."

"Herb" Hudson Joins Hazen and Sawyer Engrs.

H. E. Hudson, Jr., became associated with the firm of Hazen and Sawyer, Engineers, New York, on December 1st.

Mr. Hudson was chief engineer of the Illinois State Water Survey for the past nine years. He was graduated from the University of Illinois in 1931 in sanitary engineering and worked from then until 1942 with John R. Baylis in operation and research at the Chicago Experimental Filtration Plant and in design of Chicago's South District Filtration Plant.

"Herb" Hudson carried on research on removal of chemical agents from water at the University of Illinois from 1942 to 1944, before entering the Army, where he was assigned to the Water Supply Branch, the Engineer Board, Ft. Belvoir, Va., until 1945. While assigned there, he was detached for intelligence work on German military water purification methods in Europe.

He then returned to the operation of the South District Plant at Chicago as filtration engineer and left this post in 1946 to join the Illinois Water Survey. There he continued studies of filtration theory and headed the Survey's program of collection of basic hydrologic data.

Mr. Hudson is a member of numerous technical societies.

Practice vs. Theory

Daily, I grow to honor *facts* more and more; *theory* less and less.—*Carlyle.*

ADMINISTRATION building of Austin's new Filter Plant No. 2, with clear wells in foreground

Air Operation of Flow Controllers and Gauges in Austin's New Plant

by A. A. KALINSKE and A. H. ULLRICH

Mr. Kalinske is Director and Research and Development, Infilco Inc., Tucson, Ariz. Mr. Ullrich is Superintendent of Water and Sewage Treatment, Austin, Tex. This article describes the controlled air pressure actuated and operated control and gauge equipment installed in Austin's new Filter Plant No. 2.

MODERN water filtration plants are to a large measure automatic in operation and their performance can be controlled and indicated remotely. It is desirable to control the rate of filtration so that it will remain at some preset constant rate, irrespective of the loss of head through the filter which, of course, varies as the filter clogs. In some plants it is desirable to control the rate of filtration so that it will automatically maintain a constant water level in either the settling basin or the clear well.

In any case, it is desirable for the filtration rate to be independent of the loss of head until, of course, the loss of head becomes excessive and the filter is in need of backwashing. To accomplish this a control valve is installed in the effluent piping of gravity filters. The opening in this control valve varies automatically as the head loss through the filter bed changes so as to maintain a constant rate of filtration.

In most modern filter plants the flow rate and loss of head through each filter is indicated by use of an indicating gauge. Sometimes this gauge also records the loss of head. It is common practice to have means for varying the filtration rate from about 40 per cent of the normal design rate to about 160 per cent of the design rate, or a variation of 4 to 1. This article describes the controlled air pressure actuated and operated control and gauge equipment installed in the new Filter Plant No. 2 at Austin, Tex. This system is known as Infilco's C.-A.-P. System.

Converting Pressure and Flow To a Controlled Air Pressure

The two quantities to be measured, and which are to be recorded and which actuate various instruments, are the loss of head through the filter and the rate of flow through the filter.

The loss of head through the filter is obtained quite simply by obtaining the difference in total head between a point above the filter bed and in the effluent line from the filter. The rate of flow measurement is obtained with a Venturi differential reading.

The first step in this control system is to convert the loss of head reading and the differential reading across the Venturi, indicating the rate of flow, to a controlled air pressure which will be proportional to such loss of head and rate of flow. Hereafter in this paper this controlled air pressure is referred to as C.-A.-P., which is the name applied to this entire system of filter operation control.

Various component parts of this control system are shown schematically in Fig. 1. These parts are (a) the Venturi with the incorporated control valve, (b) the loss of head and rate of flow converters, and (c) the various parts in the rate of flow and loss of head gauge. These various parts will be discussed singly and in more detail throughout this paper.

The loss of head converter receives a differential in head across a filter and converts this to an air pressure which is directly proportional to the loss of head. This C.-A.-P. varies from 0 to 3 pounds per square inch, 3 pounds per square inch being the value of the C.-A.-P. at maximum head loss. The various component parts of this control system and the indicating and recording gauges are so designed that a variation in pressure from 0 to 3 lb is sufficient to accomplish the necessary actuation of the various instruments.

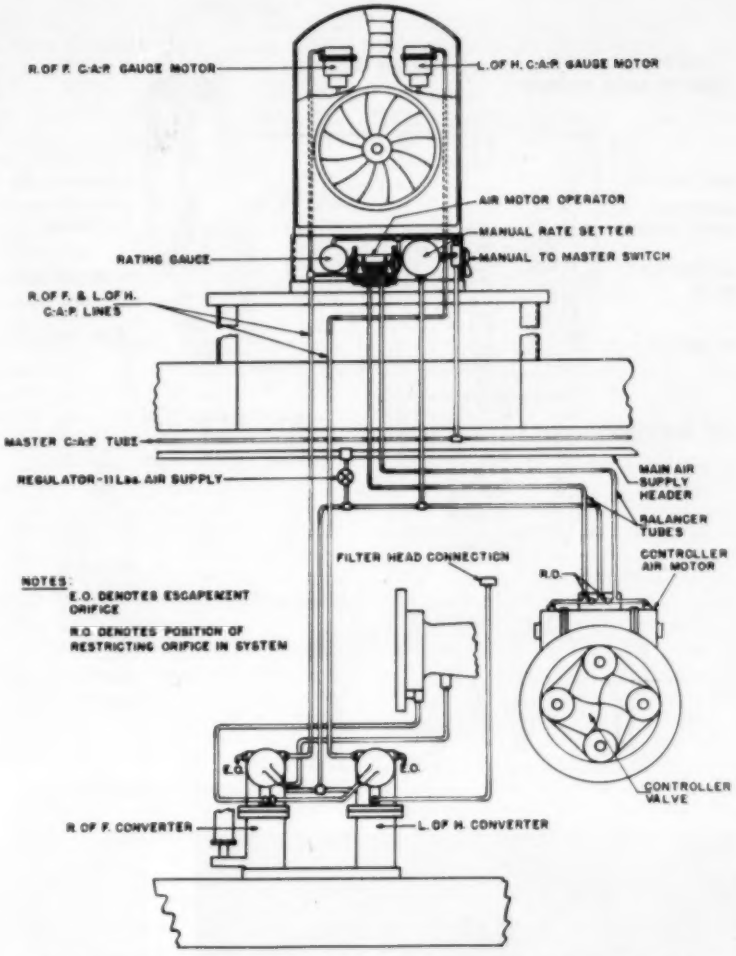
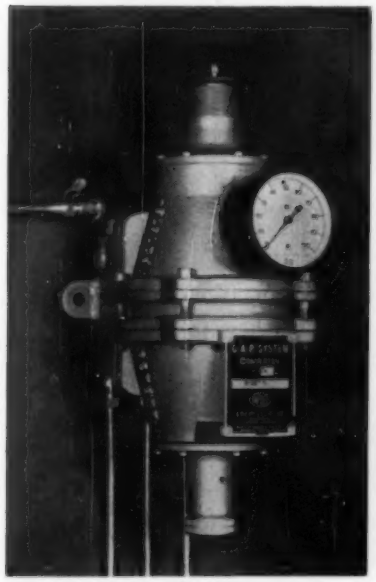
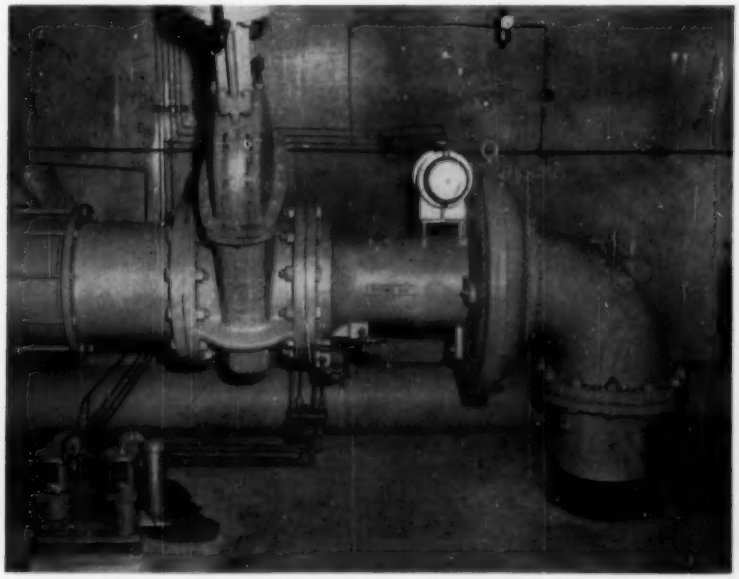


Fig. 1—DIAGRAM of gauge and filter effluent controller of C.-A.-P. system



CLEARWELL converter



FILTER RATE controller

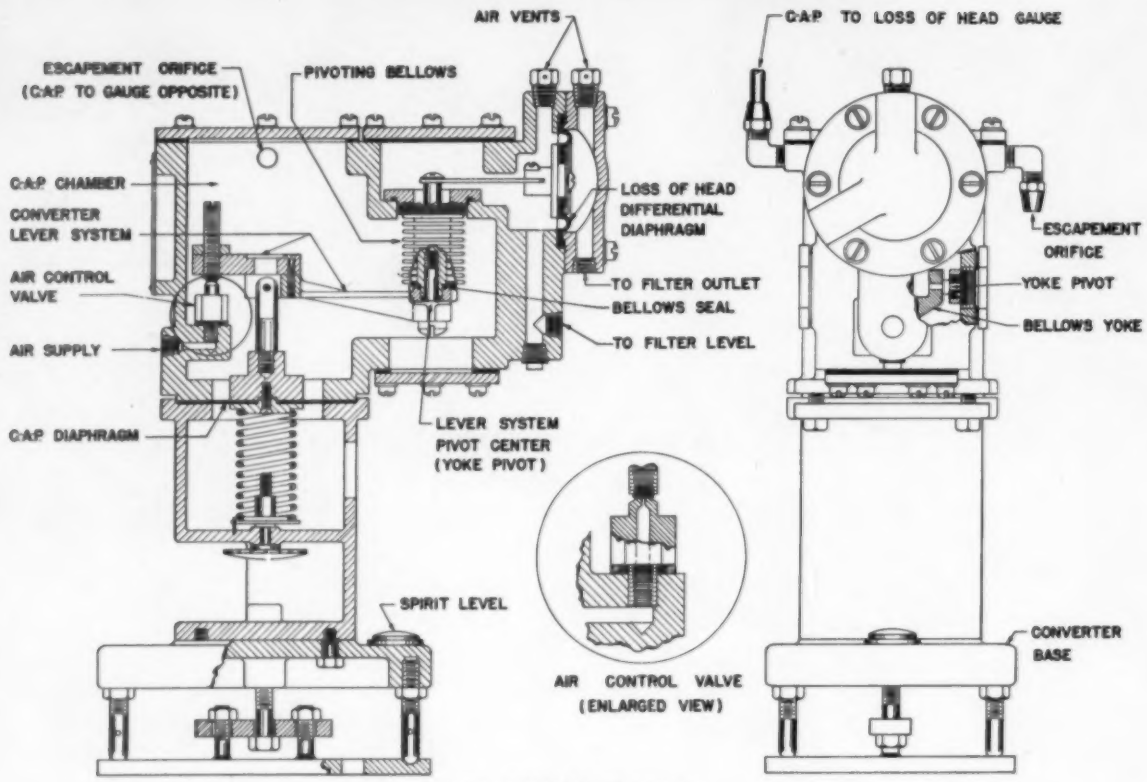
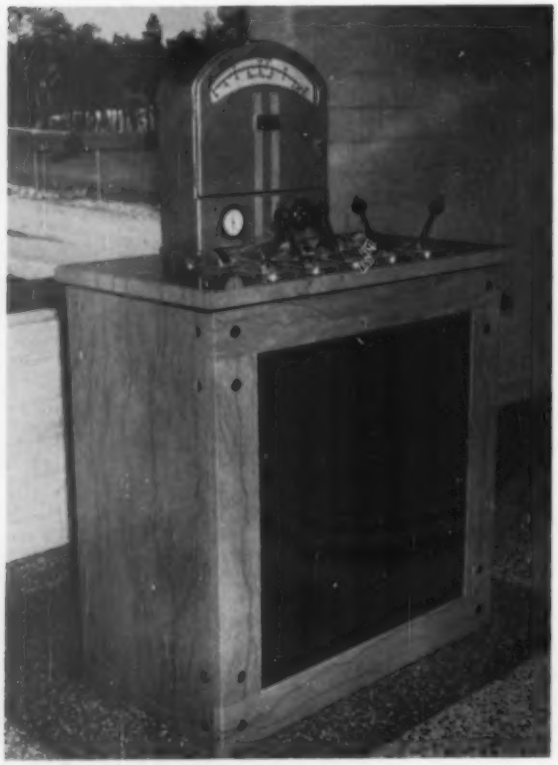
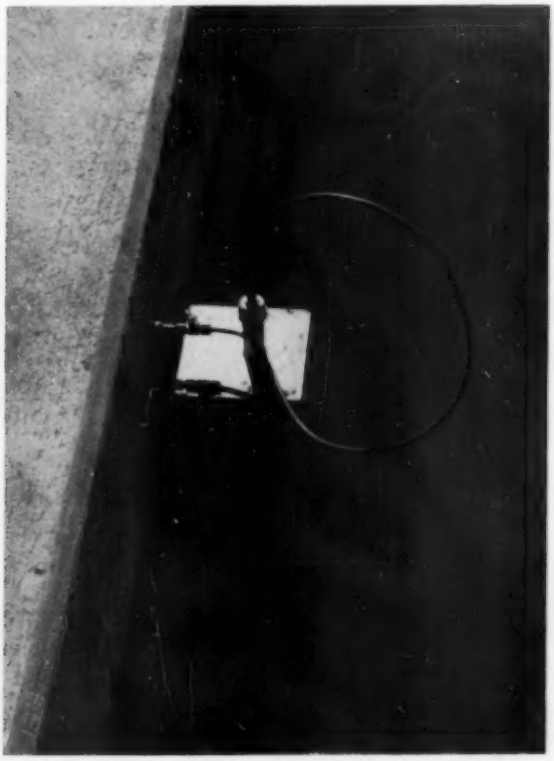


Fig. 2—LOSS of head converter



FILTER operating table based on C.-A.-P. system



AIR BUBBLING tube to control level in settling basin

In Fig. 2 is shown a detailed cross-section of the loss of head converter. This converter receives the differential in pressure across a filter on either side of the loss of head differential diaphragm shown on the upper right-hand part of the device. This diaphragm is mechanically linked through the converter lever system to the air control valve.

Filter level water pressure on a high side of the diaphragm chamber is isolated from the air system by a pivoting bellows and seal ring mounted in a yolk. The yolk pivot is the fulcrum of the converter lever system.

The air control valve is the heart of the converter. This air supply inlet valve is operated by the lever system to control the admission of air from the air supply line, which is regulated at 11 pounds per square inch, to the C.-A.-P. chamber. The movement of this valve is of the order of from 0 to 0.004 inches.

The lever system of this converter opens the air inlet valve when a force is applied to the differential diaphragm. The C.-A.-P. chamber is provided with an orifice escapement always open to the atmosphere. The orifice maintains the controlled air pressure within its operating range.

The lever system is also connected to the C.-A.-P. diaphragm at the bottom of the C.-A.-P. chamber. At zero position, the weight of the diaphragm plus its center plates and the lever system is balanced by spring tension adjusted by a manually operated knob. When the system is in equilibrium, the air control valve is closed.

The converter delivers a controlled air pressure of 0 lb at no loss of head, 3 lb at maximum loss of head, and intermediate pressures in direct proportion to the differential across the differential diaphragm. The instant the differential is received by the diaphragm, the air control valve opens and builds up a pressure in the C.-A.-P. chamber against the orifice escapement until the pressure on the C.-A.-P. diaphragm balances the differential and the air control valve is then correctly positioned.

Air consumption is quite small, varying as the square root of the C.-A.-P. from 0 at no differential to 0.03 cubic feet per minute at maximum. The C.-A.-P. chamber is tapped for a connection to the loss of head gauge or any other device operated by this loss of head C.-A.-P.

The rate of flow converter shown in Fig. 3 converts the differential pressure received from a Venturi meter or orifice plate into a C.-A.-P. which is proportional to the flow. The differential is received by the converter across a diaphragm similar to that in the loss of head converter.

The lever system controlling the air flow through the air control valve is also connected to a counterweight and paraboloid float, which is totally submerged in the mercury at zero level. The mercury well is connected to a riser tube vented to the atmosphere and provided with a filler cap and drain plug. At zero level the entire lever system, counterweight, and float are balanced by the adjustable lever balance weight and the buoyancy of the float in the mercury.

During operation the C.-A.-P. displaces the mercury in the mercury well. The instant a differential is received by the rate of flow diaphragm, the air control valve opens and builds up a pressure against the orifice escapement. This air pressure acting within the mercury well depresses the mercury until the effective weight of the uncovered portion of the paraboloid float rebalances the lever system, and the air control valve is then correctly positioned.

The system remains in balance until a greater differential on the rate of flow diaphragm causes the control valve to open further and start a repetition of the cycle. The shape of the float automatically converts the parabolic flow differential function to a corresponding linear function. The C.-A.-P. is, therefore, a direct measure of the rate of flow through the Venturi tube.

This rate of flow converter has an accuracy within ±1 per cent over the

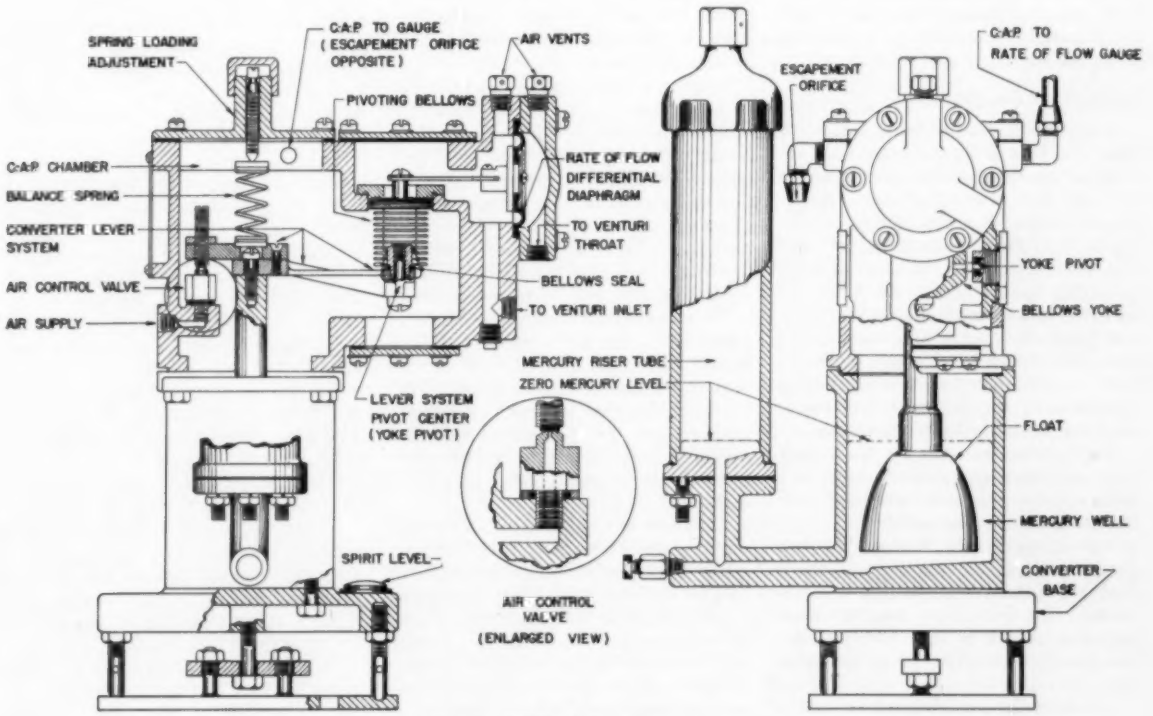


Fig. 3—RATE of flow converter

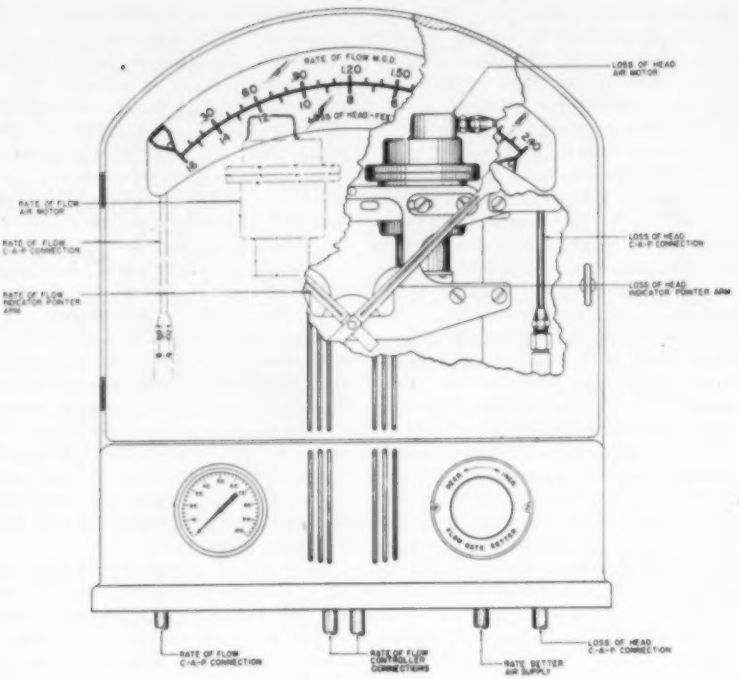

RATE OF FLOW M.G.D.
LOSS OF HEAD AIR MOTOR
LOSS OF HEAD-FEET
RATE OF FLOW AIR MOTOR
RATE OF FLOW C-A-P CONNECTION
RATE OF FLOW INDICATOR POINTER ARM
LOSS OF HEAD C-A-P CONNECTION
LOSS OF HEAD INDICATOR POINTER ARM
RATE SETTER
FLOW RATE SETTER
RATE OF FLOW C-A-P CONNECTION
RATE OF FLOW CONTROLLER CONNECTIONS
RATE SETTER AIR SUPPLY
LOSS OF HEAD C-A-P CONNECTION

Fig. 4—C.-A.-P. loss of head gauge

range from maximum flow to 25 per cent of maximum flow. Below 25 per cent the accuracy drops off slightly. The air consumption at maximum flow is about 0.03 cubic feet per minute. It will be noticed that both of these converters are instruments that are glandless, frictionless, and direct acting in operation.

Operation of Gauges

The purpose of the loss of head and rate of flow gauges is to indicate and/or record losses of head and/or rates of flow through filters. Operation of a filter is accompanied by loss of head, which increases with the length of filter run. This loss of head is caused by the accumulation of coagulated matter and dirt on the filter, and gradual packing of grains in the bed. The loss of head gauge is, therefore, a necessity, for it indicates the condition of the bed and determines the time when it should be washed.

Experience has shown that filter beds operate at greatest efficiency at a fixed rate of flow, and automatic flow controllers should be installed to maintain that rate of flow. The rate of flow gauge provides a continuous check that this optimum rate of flow is maintained. An indicating loss of head gauge is shown in Fig. 4 to indicate the general principle of gauge actuation.

In either the loss of head or rate of flow gauge the C.-A.-P., which is proportional to the loss of head or rate of flow, is connected to an air motor, which is basically a piston sealed in a chamber by a roller-type rubber diaphragm. The piston travel is biased by a helical spring held in a calibrating holder. At zero pressure in the C.-A.-P. connection, the piston is held in zero position by the spring.

The travel of the piston is converted to a 90° movement of the indicator pointer over the graduated scale by means of a rack and pinion. Movement of the rack is in direct proportion to the C.-A.-P. in the piston chamber. The rate of flow gauge operates in an identical manner, with the air motor being actuated by the C.-A.-P. from the rate of flow converter.

In general, any quantities such as liquid level, pressure, or rate of flow can be converted to a C.-A.-P. which is proportional to that quantity. This C.-A.-P. can then be used to indicate and record the particular quantity involved, and also can be used to actuate various control devices, as will be described later.

The selection of a C.-A.-P. which varies from 0 to 3 lb is, of course, quite arbitrary. Similar instruments can be designed for other ranges of C.-A.-P. values. It is desirable to keep the maximum C.-A.-P. as low as possible in order not to waste too large a quantity of air, since each of the converters uses up a certain amount of air continuously when in operation. The C.-A.-P. can be transmitted long distances through small pressure tubes and thus remote indication and control becomes very simple.

Controlled Valve Operation

In the operation of a rapid sand filter it has been mentioned that the loss of head increases as the filter run progresses, and since it is impractical to increase the operating head over the sand to offset the increasing loss of head, uniform rate of flow through the bed can be maintained only by regulating the size of the opening in the effluent line, making it proportional to the head available for producing the flow through it.

General design of the controller valve and how it is connected into the C.-A.-P. system is shown in Fig. 1. The controller consists of a compact Venturi tube and valve assembly with an air motor for operation mounted on the controller. The inlet Venturi section is of the trumpet design in order to obtain a shorter laying length.

The controller valve is of the iris type, having four vanes which move 90° each. They move in the same plane so that equal clearance between the faces of the vanes is maintained. The vanes are so shaped that they completely close, and in the closed position leakage is reduced to a minimum.

One of the controller valve vanes is used to position the valve; the spindle to which it is connected extends out and is positioned by a crank from the air motor. The other three vanes are connected to this positioning vane by a stainless steel cable. The vanes are so shaped that the open area is directly proportional to the angular movement.

Opposite vanes in this valve tend to balance each other statically, thus there is no tendency for the vanes to move from one position to another because of unbalance and no counterweights or levers are needed. Dynamically, almost perfect balance is attained against hydraulic effects by the comparatively short radii of the four vanes and their geometric shapes, which expose constant-length edges to the flowing stream in all positions. The only edges of the vanes that expose variable length to the flowing stream are circumferential to the spindles and thus are perfect in balance.

When the vanes are in wide open position no valve loss is encountered and the friction loss of the Venturi tube for any flow with valve wide open is approximately 10 per cent of the flow head differential.

In addition to controlling the filter effluent, this controller can be used for controlling the filter washing operation. It is also suitable for use

wherever it is desired to maintain a constant or uniform flow of liquid through a pipe regardless of the variations in the head available for producing the flow.

The air motor actuating this valve consists of a double-ended piston, each end being sealed by a roller diaphragm. Air pressure at approximately 11 pounds per square inch for operation is supplied through the port box mounted on the motor. Restrictive orifices in the port box between the air pressure supply connection and each piston connection cushion the action to provide smooth movement of the piston.

Each piston connection has a bleeder line to what is called the air motor operator or positioner device, which is located in the bottom of the gauge case as shown on Fig. 1. This air motor operator is a double diaphragm-operated two-port escapement or bleeder device, which in neutral position bleeds equally from both pressure chambers of the air motor on the controller.

One of the diaphragms seals off a rate setting chamber, which is connected to a rate setter. The pressure to this chamber can be controlled manually or automatically. The other diaphragm receives the C.-A.-P. from the rate of flow converter. Therefore, pressures in the two chambers oppose each other. The C.-A.-P. received from the rate of flow converter is, of course, directly proportional to the rate of flow.

Hence, after a pressure is set in the rate setting pressure chamber corresponding to any desired rate of flow, the air motor operator will not attain neutral position until the pressure in the C.-A.-P. chamber balances it. Desired flow is then passing through the rate controller. If the flow through the rate controller drops off, the rate of flow converter immediately establishes a lower C.-A.-P. in the C.-A.-P. chamber. This unbalances the equilibrium of the air positioner, causing the bleeder valve disc to move to opening position.

In this position one of the bleeder valves is open and the other is shut. This builds up pressure in one of the controller valve piston chambers and reduces it in the other, causing the air motor to move and correct the valve opening to the point where the set flow is re-established, and, by the rate of flow converter, re-establishes equilibrium in the air positioner.

Filter effluent controllers are located in pipe galleries below the filters, while the gauges are up on the operating floor of the filter plant. By the use of the rate setter, which is a part of the gauge case mechanism, it is possible to set any desired filter rate on the operating floor—or, for that matter, from any other point where the indicating and recording gauge is located. Such remote control is very desirable.

OPERATING floor for Austin's new filters

Sometimes it is desirable to have the filter rate vary in accordance with the level in the clear well or, as in the new Austin plant, with the level in the settling basin. This can be readily accomplished by connecting the rate setting pressure chamber in the air positioner to an air pressure which is proportional to the level in the clear well.

Such an air pressure would be obtained from another converter that converts the liquid level in the clear well to a C.-A.-P. which is proportional to the clear well liquid level. Then as the clear well liquid level changes the pressure in the rate setting chamber of the air positioner will change and will automatically increase or decrease the filtering rate. Thus the plant becomes entirely automatic in its operation.

Summary

Air operated flow controllers of various kinds are not new. However, many of these devices have been designed for applications so different from those required for filter plants that many of their advantages are lost or, in some cases, they fail to meet peculiar requirements for this particular use.

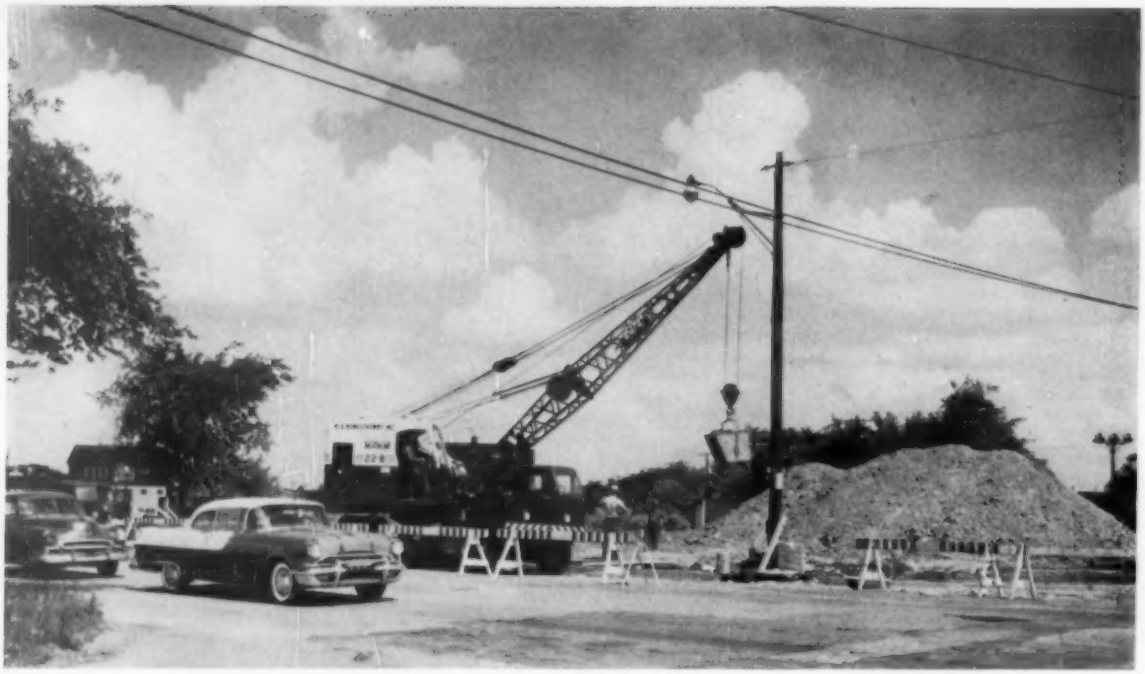
The system of air operation of control valves and indication of loss of head and rate of flow through the filters described herein was designed primarily for indicating and controlling the operation of a gravity filter plant. However, this system can be used for controlling the flow through, say, zeolite softeners and other operations where there is a changing head as the flow continues and it is desired to maintain a constant flow even though the head producing the flow is changing with respect to time.

The general principle on which this system operates depends on converting liquid levels and rate of flow values to a controlled air pressure which is proportional to the liquid level or rate of flow. This controlled air pressure is then used to actuate gauges or control the opening of valves through the use of air motors or air motor devices.

The operator of such a plant can have his indicating and recording instruments a considerable distance from the point where the operation is taking place, and he can also control his operation remotely. Such flexibility in the placing of controllers, gauges, etc., is very desirable.

Use of a controlled air pressure as the actuating medium eliminates stuffing boxes, mercury chambers, and cables, and assures positive reaction to the changes of flow or liquid levels. By using a filtered and, if necessary, a dehumidified air supply, all difficulties with clogging of small ports or corrosion of valves, etc., are practically eliminated.

The controlled air pressure system in Austin's new plant has now been in operation about a year and a half. It has been completely trouble free and has given perfect control of the filters.



Traffic flows freely along intersection near Tonawanda, N. Y. as truck crane cleans out around tunnel borer

Transit Crane Proves Workhorse on Unusual Water Main Job

Tonawanda pipeline project includes 900 feet of tunnel work under highway intersections and railroad tracks

by DANIEL J. CONLON
Bucyrus-Erie Company
South Milwaukee, Wis.

GROWING pains are common to many American communities—young and old alike—in a rapidly expanding industrial age. As a small village or town grows in population and area, public officials are confronted with the difficult problems of providing additional utilities, building new roads, etc.

Among such blooming villages is the Town of Tonawanda, just a few miles north of Buffalo, N. Y. It lies at the easternmost juncture of the Tonawanda Channel which, with the Chippewa Channel on the west, splits the Niagara River to circumvent Grand Island before spilling over famous Niagara Falls.

Not the least among the town's present problems is that of meeting water demands of both domestic and industrial users.

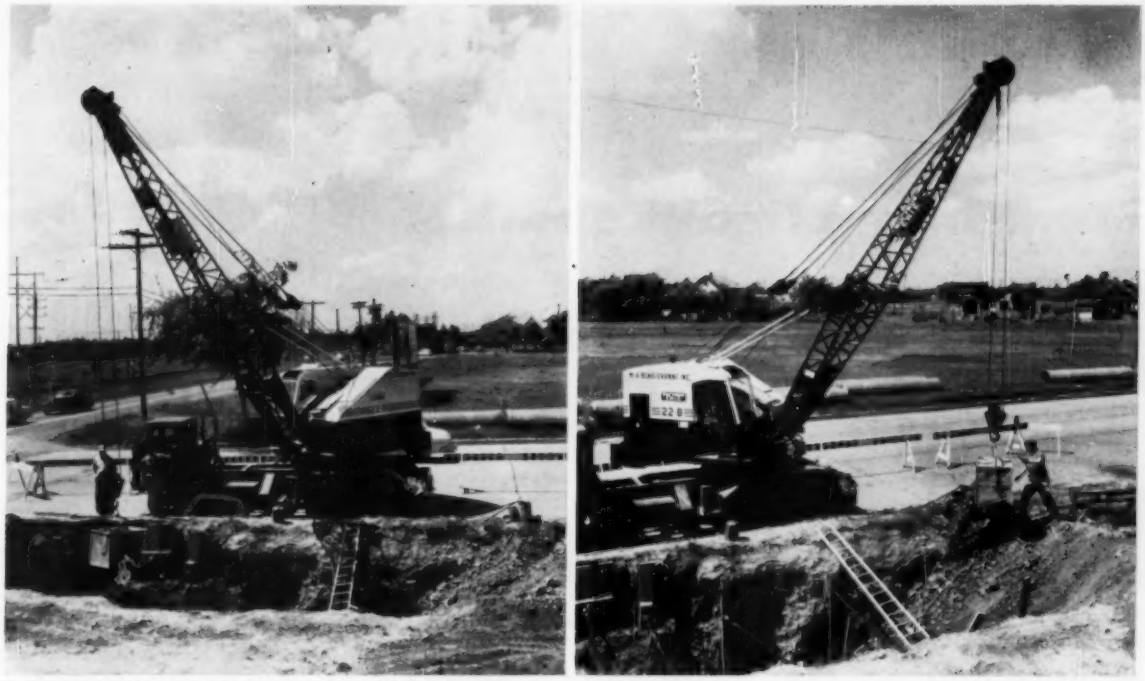
The Town of Tonawanda is an industrial center whose residential areas have mushroomed due to a heavy influx of skilled laborers. As a forward step in solution of one of their city's expansion problems, officials have undertaken an extensive program which includes building of a new intake into the Niagara River, a new pumping station, and a new water treatment plant.

In conjunction with additions to the water supply system, a new transmission main was required. The $830,000 contract to put in a 6.25-mile long feeder main pipeline system from the treatment plant to city users was let to M. A. Bongiovanni, Inc., General Contractor, of Syracuse, N. Y.

The contract covered a route in a northeasterly direction, much of it along busy Sheridan Drive in suburban Buffalo. A major portion of the work involved ordinary trenching. However, state legislation—affecting a portion of the work—made this a tough assignment. Tunnel work was required under all railroad crossings and county and state highways where open cutting is restricted by law. The new transmission main crosses 15 to 20 such intersections, and 900 lineal feet of underground boring was necessary. All intersections were kept open during boring operations.

Tunnel Work

The first and longest of the tunnels required on this contract was located at the Kenmore Avenue - Sheridan Drive intersection. Railroad tracks, running parallel to Kenmore, necessitated a tunnel drive of 104 feet. Casing here consisted of three sections—



INEXPENSIVE 1-yd bucket was filled and dumped by hand because loose clay being removed was usually in areas inaccessible to clamshell bucket. Note adjustable steel braces for 12-ft deep pit providing working space for horizontal auger

two 40-ft and one 24-ft weld-jointed units. The casing was 48-in. OD x 3/16-in. wall steel. Both 30-in. diameter Lockjoint prestressed concrete cylinder pipe and 20-in. diameter mechanical joint cast-iron pipe were used.

For this type of work, a Ka-Mo horizontal earth auger, powered by a 53-hp International gas engine, was used to bore out the tunnel and at the same time drive the casing under the intersection. Two 12 x 12-in. x 24-ft long timbers, bridging the boring pit at the head end of the tunnel, acted as a deadman for winches which pulled the casing into the bank.

The boring machinery was based in a wide trench about 12 feet deep, the base of the tunnel being about the same depth under the road. This method was followed on each of the intersections. However, the standard trench along 95 per cent of the line was only 6 feet in depth. Most of the trenching was assigned to one of Bongiovanni's dragshovels.

Trenching

Excavation figures are not available. Superintendent John C. Taggart, in describing the activity, explained that yardage is relatively unimportant in this type of work as most of the dirt was put back on the pipeline. The material was mostly clay with occasional boulders.

Although trenching was handled by conventional hoe equipment, a variety of work around the boring operation, plus maintenance assignments along the line, were handled by a new Bucyrus-Erie 22-B Transit Crane, a 25-ton carrier-mounted lifting crane.

The mobile crane was used wherever the need arose, including rearranging pipe, setting in valves and pipe, and cleanup work around valves and pipes from one end of the line to the other. It also was used to clean up around the boring machine, where it occasionally was necessary to free the casing of loose clay deposited from the cuttings and from minor slides along the trench wall.

For this latter work the crane was fitted with a 1-cu yd tilt-bucket, which was lowered into the hole, filled by hand shovel with clay from inaccessible areas under the casing, then raised and dumped to the rear of the trench. Excavation of the work area also was handled by the Transit Crane, equipped with ¾-yd clamshell.

In addition, the crane was used as a supporting and leveling device for the auger. After lowering the 5-ton boring machinery into the trench it assisted in keeping the auger level to prevent sliding up, down, or sideways, and to minimize binding along the trench floor, which was spot lined with 12 x 12-in. timbers.

For this work, the crane was equipped with a standard short boom, 30-ft long without inserts. This was advantageous in short, heavy lifts and for working near intersections where low overhead wires, etc., were frequent problems. A boom angle indicator, located on the boom, varied from 30 to 60 degrees through most of this job.

The crane operator is George A. Chaffee who has had 44 years of experience on cranes and draglines.

Atlanta Water Meter Readers Go 'Round on Three Wheels

The Atlanta, Ga., water works is trying out a three-wheel motor vehicle for the meter readers to make their rounds in, according to the American Public Works Association.

More than 100,000 meters have to be read every month now, and 3,000 are added each year. Readers had a problem in the city's outlying sections, where the distances were long between meters. The hope is that the motorized tricycle will speed things up.

The vehicle is built on a three-wheel chassis and has an enclosed cab. It is powered by a 5-hp motor and started by pumping a pedal on the side of the engine. It costs about $1,000, can go 35 miles per hour, and gets 50 miles to a gallon of gas.

WATER WORKS PRACTICES

Mixing and Sedimentation

The Twenty-sixth of a Series

THE PREVIOUS LECTURE dealt with the subject of coagulation. Inasmuch as mixing and flocculation comprise the two phases of coagulation, they too were discussed, particularly as to principles. Mixing and flocculating devices, however, were referred to only briefly. Therefore, this lecture will discuss these devices as well as the subject of sedimentation.

by GEORGE E. SYMONS, Ph.D.
Dr. Symons is Consultant and Technical Editor, Larchmont, N. Y. In this series he discusses *Water Works Practices* in the form of short course lectures. These are designed to assist plant operators, students, and all who wish to review fundamentals in this field.

A . . . Mixing and Flocculating

1 . . . MIXING BASINS

a. Early mixing of coagulating chemicals and water utilized raw water conduits to provide mixing before sedimentation, but the length of conduit required was excessive and mixing and flocculation inefficient.

b. More effective flocculation can be obtained in basins baffled to provide distance of travel, change in flow rates and direction of flow, thus providing mixing and flocculation.

(1) Baffles may be horizontal or vertical.

(2) Velocity of flow and mixing efficiency depends on the rate of flow through the plant.

. . . At full capacity, linear velocity is four times that at ¼ capacity flow.

. . . Regardless of rate of flow, velocity around the baffles themselves may be high enough to break up floc, previously formed.

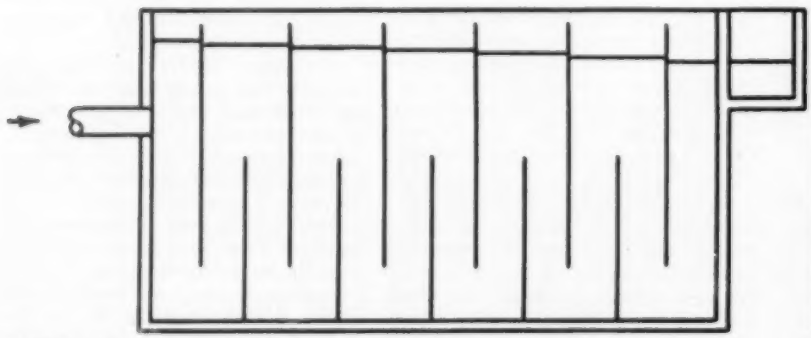
2 . . . MECHANICAL MIXERS

a. Mechanical mixing devices can provide optimum rate of mixing both for rapid dispersion of coagulant and for slow flocculation reaction, independently of rate of flow.

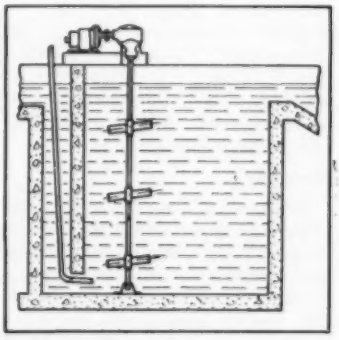
b. Rapid or flash mixers are usually high speed paddles, from 3 to 10 ft in diameter, revolving in a horizontal plane on a vertical shaft.

(1) Two or more rows of paddles may be used.

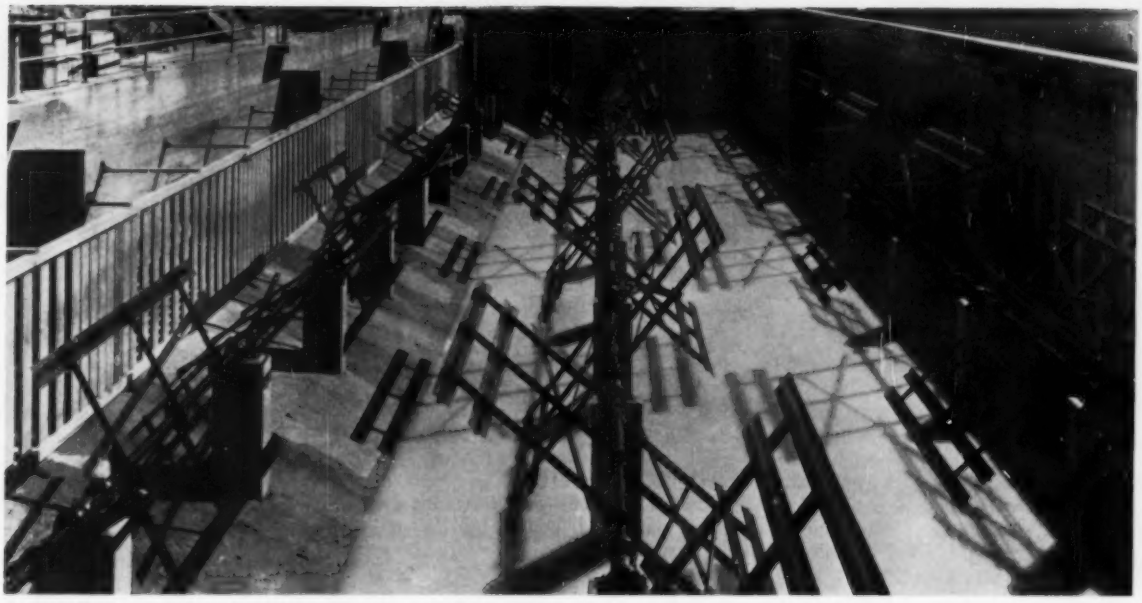
(2) Flash mixing is generally kept below 15 seconds; even in large rapid mix basins, or wells, not more than one minute is required for complete dispersion of the chemicals.



BAFFLED mixing basin



MECHANICAL mixer



MECHANICAL flocculator with paddle rotation at right angles to flow

c. Flocculating basins contain slow moving paddles or lattice baffles, which revolve at peripheral speeds below 1.3 ft per sec.

(1) One type of flocculator consists of a series of paddles transverse to the tank width. They rotate out of phase and impart a barrel roll effect and eddys in the water, causing the floc particles to pass up and down as they move forward in the tank.

(2) A second type consists of a central shaft longitudinally parallel to direction of flow, with attached paddles rotating about the shaft.

. . . Paddle area decreases in the direction of flow in order to provide lessening agitation.

. . . Baffling at intervals in the tank prevents short circuiting through a "core".

(3) A third type, the "walking-beam" flocculator consists of inverted V's running full width of the tank across the direction of flow; several inverted V's may be hung one above the other, and each is of longitudinally slotted construction, with each group hung from opposite ends of a walking-beam located above the water.

. . . The walking-beam moves the inverted V's alternately move up and down through a distance of about two feet, thus providing gentle swirling and churn-like mixing action productive of coalescense of floc particles.

d. Other mixing devices:

(1) The hydraulic jump wherein water and chemical solutions pass down an open sloping flume to a pool where rapid mixing is effected where the rapidly moving water is suddenly slowed.

(2) Mild æration has also been used for mixing and flocculation.

B . . . Sedimentation

1 . . . Theory

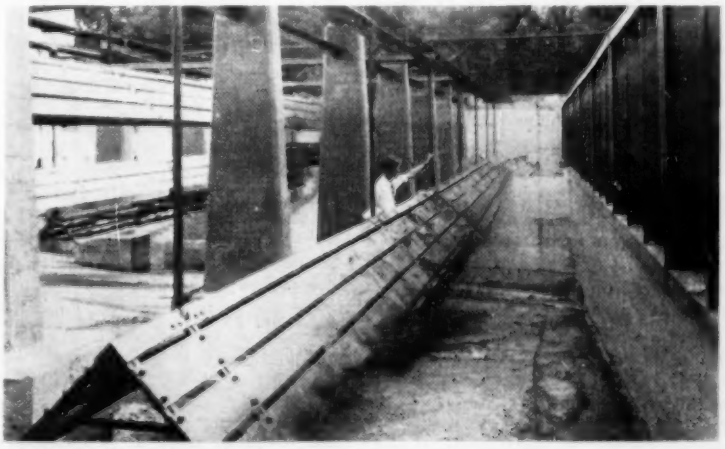
a. Sedimentation is a unit process of water treatment whereby the carrying power of flowing water is reduced by slowing the linear velocity until discrete suspended particles of matter will settle out under the influence of gravity and will not be resuspended by any scouring action.

b. Particles having a density greater than that of water will settle in quiescent water, because of the force of gravity.

(1) Rate or velocity of settling will accelerate until the resistance of the liquid equals the effective weight, or its weight in the suspending liquid.

$$W_e = (d_s - d)_g V$$

where W_e = effective weight
d_s = density of particle
d = density of liquid
g = gravity constant
V = volume of particle (size and shape)



WALKING-BEAM flocculator

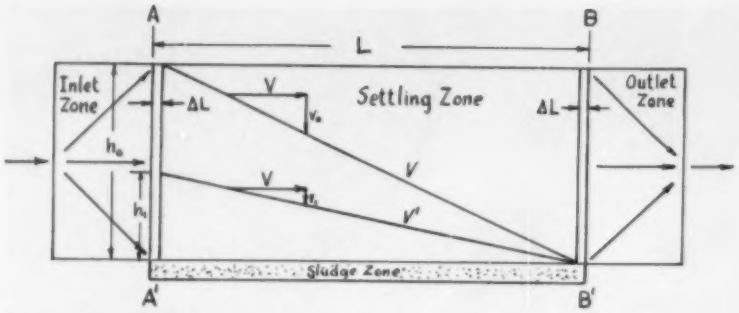


Fig. 1—Ideal sedimentation tank (after Camp)

(2) This formula states that the settling velocity, having reached its maximum, it will remain practically constant and that it depends on size, shape and density of the particle in relation to the density and viscosity of the water.

c. For computations of settling velocities, it is generally assumed that suspended particles are spherical; experimental studies of the various laws of sedimentation, indicate that they apply to discrete spheres.

d. Many factors affect actual sedimentation rates.

(1) Specific gravity.

... Turbid waters may contain suspended matter from sand particles (Sp. G.-2.65) down to floc particles of mud and organic matter (Sp. G.-1.03).

... Alum floc has a Sp. G. of 1.18; iron floc of 1.34.

(2) Movement of water.

... In moving water, settling rates will tend to be retarded if the linear movement of the water is such as to create convection currents which tend to resuspend the particles. Above certain minimum velocities scouring effects set in.

... In water plants the ideal settling basin is one in which the horizontal movement of the water is slow enough that to all intents and purposes, no convection or vertical currents exist and settling of suspended matter proceeds as if under quiescent conditions.

(3) Shape, agglomerations and concentration of particles.

... Suspended solid particles in water are never exact spheres, therefore they have greater surface area in relation to volume, and tend to settle more slowly than spheres of the same volume.

... As particles coalesce to form flocs, the ratio of effective surface to volume changes and settling rates of the clustered particles generally increase.

... The greater the number of particles, the more they tend to hinder settling rates by interference with each other. Camp states that at concentrations of 1 per cent, interference will reduce settling velocities by 10 per cent or more.

2 ... Theory in Practice

a. T. R. Camp, formerly Professor of Sanitary Engineering at Mass. Inst. Tech., now a consulting engineer in Boston, has developed an important concept of modification of the ideal settling basin as applied to practical design.

b. Camp's ideal basin is shown in Fig. 1, and he postulates performance as follows.

(1) Any segment of water entering the inlet zone of the basin spreads out uniformly over vertical plane A-A'.

... Particles are uniformly distributed as to size and density throughout the segment, shown as $\triangle L$.

(2) This segment, or incremental volume of water, moves through the tank at constant velocity to the outlet zone, B-B'. The segment does not change shape during passage through the tank.

(3) Particles settle discretely and those which strike the bottom between A' and B' are removed.

... Particles which are not removed in the settling zone are carried out.

... Particles which reach the bottom may tend to roll if the velocity of flow is above a critical rate. This critical rate is expressed in terms of ratio of horizontal velocity to settling velocity for the smallest particle to be removed, and should not exceed 40 to 1, preferably perhaps 20 to 1.

(4) The absolute velocity path *(V)* represents the maximum elevation below which complete removal will take place for all particles of smallest diameter (d_o).

... Such a particle entering at the surface elevation (h_o) will just be removed as water travelling at velocity (V) reaches B-B', represented by line *(V)*.

... Similar particles entering the tank below the surface will settle in a path parallel to A-B' and reach the bottom proportionately between A'-B'.

... Actual settling velocity (v_o) depends on particle size and density.

(5) Particles (d_1), smaller than (d_o) but of same density, settle more slowly indicated by (v_1) and therefore follow the path indicated by line *(V')*.

... If they enter the tank above (h_1) they will not be removed.

c. Mathematical considerations of these various relationships produce the

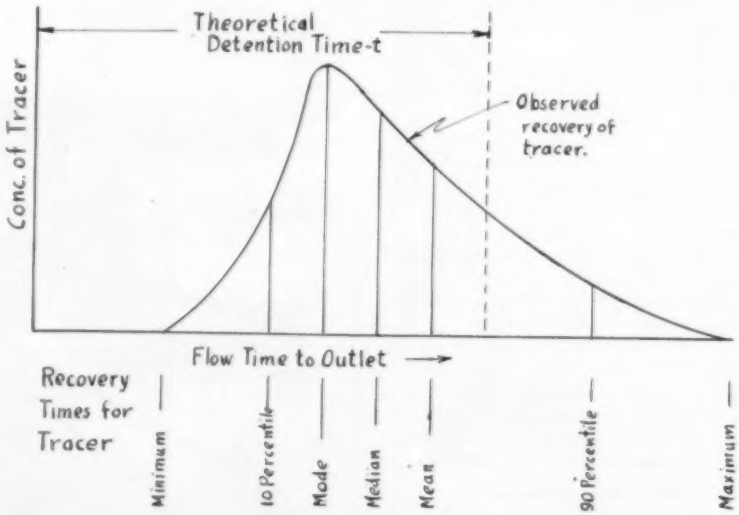


Fig. 2—Tracer study of flow-through time and short-circuiting in settling tank (after Fair & Geyer)

RECTANGULAR sedimentation tank with straight line sludge collectors

fundamental concept of basin overflow rate as the most important criterion of settling efficiency when horizontal velocities in the tank are approximately uniform.

(1) Since the ratio of (V_o) to (V_1) equals the ratio of (h_o) to (h_1) the percentage removal of particles smaller than (d_o) is equal to (V_1/V_o) x 100 with these settling velocities being determined from the appropriate laws of sedimentation.

. . . For the several laws of sedimentation and their applicable ranges of particle size, see Table 8-1, in Chapter 8 (revised) of the AWWA "Manual of Water Quality and Treatment."

(2) The time required for particles to settle in relation to depth and settling velocity can be equated to the tank volume divided by the inflow rate, from which it can be shown that settling velocity is equal to inflow rate divided by surface area of the tank.

. . . By applying this relation in Stokes law of sedimentation, it can be shown that the smallest particle which will be removed completely is theoretically a function of the surface loading known as the "overflow rate."

d. Surface loadings or overflow rate is best expressed as vertical displacement in feet per hour as opposed to settling velocity in feet per hour. The AWWA "Manual of Water Quality and Treatment" gives these values for typical settling velocities and overflow rates expressed in gal/sq ft/day.

(1) Alum—settling velocity, 2 to 3 ft/hr; overflow rate, 360 to 540 gal/sq ft/day or 2 to 3 ft/hr.

(2) Lime softening floc — settling velocity, 3 to 6 ft/hr; overflow rate, 540 to 1080 gal/sq ft/day or 3 to 6 ft/hr.

(3) Upflow classifier with lime floc sludge blanket—upflow velocity 6-12 ft/hr; overflow rate 1080 to 2160 gal/sq ft/day or 6 to 12 ft/hr.

3 . . . Detention vs Flow-Through Time

a. In the ideal basin, where each increment of water $\triangle L$ flows at a constant rate through a settling tank, the "detention time" is the length of time for that segment to flow from one end of the tank to the other.

(1) Detention time is time required to fill a tank at a given rate of flow.

(2) Detention time is calculated by dividing the volume of the tank by the rate of flow through it.

(3) Detention time is related to overflow rate by this formula:

$$T_h = \frac{d}{R_o}$$

where T_h = Detention time in hours.
d = Water depth of tank in feet.
R_o = Overflow rate (vertical displacement) in ft per hr.

b. Theoretical detention time applies only to the ideal sedimentation tank, but in essence since it is a function of overflow rate, it is a fundamental factor in the actual removal of suspended particles in any tank.

(1) Other factors besides detention time affect particle removal; these include flocculation, depth and shape of basin, viscosity (temperature of water), convection and wind currents, method of operating the tank, electrical phenomena, biological activity.

(2) The designed detention time of a particular tank depends on the use to which it is to be put.

. . . For coarse particle removal only, a maximum detention time of 3 hours is probably sufficient.

. . . For plain sedimentation, where removal of fine particles is required, maximum detention periods may be up to several days.

. . . For most water plants utilizing coagulation, a detention time of 3 to 5 hours is common. Economy of construction may be a governing factor.

c. Flow-through time as opposed to the theoretical detention time is the minimum time required for a particle of water to pass through a settling tank.

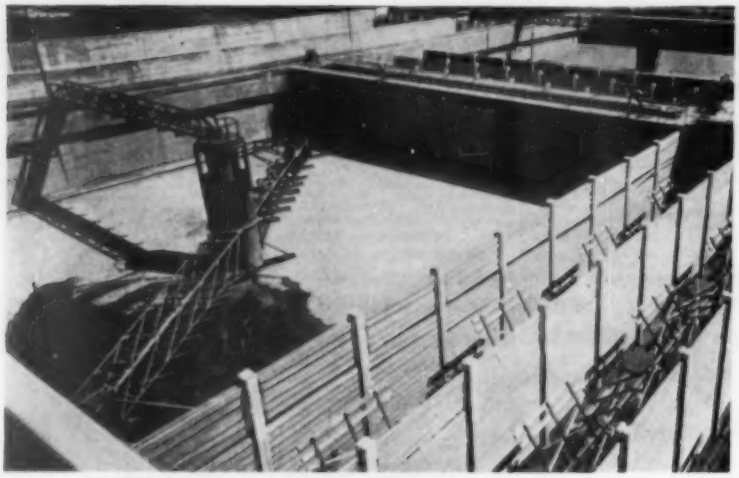
(1) Stray currents and short circuiting, cause some of the incoming water to pass through the tank in but a fraction of the detention time while other parts of the inflow take more time than the detention time to pass to the outlet.

(2) The detention period may be from two to twenty times the flow-through period.

. . . Design of inlet and outlet structures to approach the ideal tank is important in producing a maximum flow-through time.

(3) Flow-through time, short circuiting and effective detention time are best determined by the addition of a tracer (dye, electrolyte, radio-active substance) to the influent and determining its discharge time at the outlet.

. . . Fair and Geyer have shown the general pattern of the distribution and flow pattern of water passing through a sedimentation basin. That



SQUARE sedimentation tank with rotating sludge collectors

pattern is shown in Fig. 2. In practice the higher the mode of recovery and the nearer it occurs to the theoretical detention time the better the operating efficiency of the tank.

C . . . Sedimentation Tanks

1 . . . Design Factors

a. The AWWA "Manual of Water Quality and Treatment" lists these items as important to the design of settling tanks.

(1) Plant Capacity
(2) Type of treatment and water characteristics
(3) Number of basins
(4) Size and shape of basins
(5) Inlet, intermediate and outlet arrangements
(6) Detention and flow-through time
(7) Overflow rate and velocity of linear flow
(8) Sludge storage and removal
(9) Cover

b. Brief comments on some of these points.

(1) Basins must be large enough to produce good results at peak loads.

(2) Basins should be arranged in pairs to permit alternate cleaning or maintenance. Single units result in loss of settling process when out of service for any reason.

(3) Inlet and outlet structures should be designed to produce the pattern of flow in an ideal tank insofar as possible. Baffles in the tank may prevent short circuiting and covers will prevent temperature convection and wind current effects.

(4) According to the AWWA, a survey of 60 large water plants indicated that the theoretical linear velocity of flow ranged from 0.5 to 5.7 ft per min, and averaged 1.9 fpm. Overflow rates and detention period were not given for these plants.

(5) Provision must be made for sludge storage capacity between cleanings unless sludge is continuously and mechanically removed.

(6) Other comments on these factors affecting design will be made under the section on Types of Settling Tanks.

2 . . . Types of Settling Tanks

a. Rectangular tanks constitute the majority; they vary in size up to 400 ft wide, 1660 ft long and 23 ft deep. Average depth is probably 16 ft. When not provided with continuous sludge removal, sloping or hoppered bottoms are used to facilitate sludge removal.

b. Circular tanks of either concrete or steel are now widely used, usually with mechanical sludge removal equipment. In most of these tanks the flow enters at the center of the tank and flows outward radially to a peripheral weir.

c. Upflow basins combine mixing, flocculation, sedimentation and sludge removal in a single unit.

(1) These are commonly termed sludge blanket units, or suspended-solids contact clarifiers.

(2) The principles of operation of these clarifiers was described in the lecture on coagulation.

(3) These devices are compact as to space requirements, and allow high take off (overflow) rates, which means the detention time may be reduced to as little as 45 minutes, although it may be twice that.

(4) These upflow clarifiers are especially effective for water softening, where the precipitation of colloids on previously formed sludge nuclei is basic to the operations.

(5) Sludge removed from upflow clarifiers contains less free water than that from other types of settling tanks.

d. Other Tanks.

(1) Unusual designs of settling tanks include two story, with one story containing flocculating equipment.

(2) A newer design recently introduced consists of a series of concentric tanks, the inner one providing mixing and flocculation, the second sedimentation and the third filtration. This is known as the Aldrich "Peri-Filter."

3 . . . Operation

a. Plain sedimentation tanks which precede regular coagulation and sedimentation processes are used on such muddy waters as the Missouri River where turbidites may run up to 40,000 ppm.

(1) Suspended matter removed is heavy and large silt particles, which can be removed in short settling periods without coagulants.

(2) Removing these silt particles reduces the load on the coagulation and sedimentation basins.

b. Plain sedimentation in impounded reservoirs or lakes for the purpose of clarification without further treatment requires storage capacity of several days to weeks. If the silt load is light, the life of the reservoir will be long but siltation of reservoirs in muddy rivers will soon markedly reduce the capacity of the reservoirs.

c. The primary purpose of coagulation and sedimentation is to reduce the suspended particle and bacterial load on the filters.

Good control of coagulation with effective sedimentation tank operation will reduce the bacterial load by 65 to 70 per cent, and will reduce the turbidity load to less than 10 ppm; many times to less than 5 ppm, particularly if coagulant aids, such as activated silica, are used.

d. Studies of flow-through times and short circuiting patterns are helpful in determining operating procedures.

(1) Settling tanks in which flow-through times cannot be reproduced at the same flow rate are unstable and will produce erratic settling results.

. . . It has been reported that circular settling tanks tend to be unstable in flow patterns.

. . . Minor revision of baffling arrangements may provide the necessary stabilization desired.

(2) Water plants that operate on

intermittent schedules may find that severe short circuiting of settling basins occurs when the plant starts up. Scouring velocities across the bottom of the tank at such times may pick up appreciable loads of settled sludge and carry it onto the filters.

e. Taste and odor control in settling tanks may be a problem.

(1) If algae growths in sedimentation tanks or reservoirs contribute to the taste and odor problem, good control can be effected by the blackout technique.

. . . Approximately 0.25 lb of activated carbon is added per 1000 sq ft of reservoir surface. This activated carbon prevents the penetration of sunlight and effectively reduces algae growth as well as adsorbing odors already present in the water. Spreading by spraying a carbon slurry is most effective.

(2) Where putrefaction of the accumulated sludge presents a taste and odor problem, the addition of activated carbon is desirable. It may be added with the coagulants or sprayed over the surface of the reservoir at intervals. Heavier than normal doses of chlorine may also be used.

f. Most of the problems of operation of sedimentation tanks come from settled sludge.

4 . . . SLUDGE STORAGE AND REMOVAL

a. Tanks which do not provide mechanical sludge removal must provide sludge storage capacity sufficient for the accumulation between cleanings.

(1) If putrefaction occurs and sludge tends to become gas lifted, cleaning at frequent intervals may be necessary.

(2) If sludge is allowed to accumulate to the point where it appreciably affects the detention time, the velocity of flow through the tank may be increased to the point where bottom scour will resuspend some of the settled sludge.

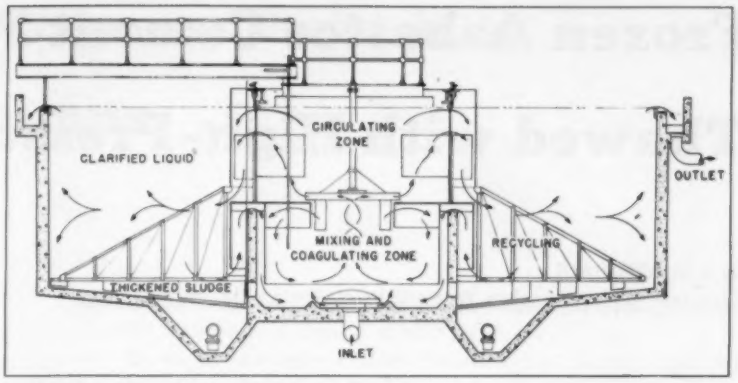
(3) Cleaning procedures usually involve unwatering the tank and removing the settled sludge to a waste water sewer.

. . . Hoppered bottoms aid in flushing out the accumulation as the tank is unwatered.

. . . Residual sludge may be hosed to a sump pump or flushed to the sewer directly.

. . . Of recent years some consideration has been given to the stream pollution effect of these discharges of contaminated settling tank sludge, but no trend in practice has developed.

b. Mechanical removal of sludge is practiced in nearly all circular tanks and in many rectangular tanks.



UPFLOW clarifier of sludge blanket type

(1) In circular tanks, a set of scrapers or plows attached to rotating arms, plow the settled sludge to the center sump from which it is pumped to waste, or the arms contain orifices, which under suction cause the sludge to be "vacuum cleaned" from the bottom of the tank.

(2) In rectangular tanks, scrapers or flights are linked at intervals between chains which move longitudinally through the tank.

. . . These flights scrape along the bottom, usually counter current to the flow of water and move the sludge to a sump. As the flights return along the surface of the water they may act as skimmers for floating material if any.

. . . In wide tanks, cross collector flights are used to transport the sludge to a single sump from which it is removed to waste.

. . . These plows, flights, or vacuum cleaners move at a low velocity usually less than 15 ft per min in order not to create currents that will cause settled particles to be resuspended.

. . . Use of mechanical sludge collecting and removal devices appear to be economical when the volume of sludge is more than 0.1 per cent of the volume of liquid flowing.

. . . Where sludge is continuously removed a portion can be returned to the incoming water to act as a coagulant aid by providing nuclei.

(3) Up-flow clarifiers usually maintain a sludge blanket of a certain depth in relation to tank design.

. . . This level is maintained by automatic hydraulic blow-off and/or recirculation.

D . . . History

1 . . . ANCIENT

a. Sedimentation as a means of clarifying water dates back to the unwritten lore of nearly 40 centuries ago.

b. No special emphasis was given to sedimentation even in the years of 1600-1800.

2 . . . MODERN

a. Plain sedimentation received impetus about 1800 in Scotland.

b. First settling basin in the U. S. was at Lynchburg, Va., in 1829.

c. Coagulation and sedimentation dates from 1885 when the first studies began at Somerville and Raritan, N. J. and at Rutgers University.

d. More complete data on the history of coagulation and sedimentation appears in the first lecture in this series.

E . . . References

Material for this lecture was based on the following sources:

AWWA—"Manual of Water Quality and Treatment," Chapter 8. (revised).

JAWWA—Aug. 1955, p. 768.

Fair and Geyer—"Water Supply and Waste—Water Disposal," Chapter 22 (John Wiley and Sons).

Babbit and Doland, "Water Supply Engineering," 5th Ed. (McGraw-Hill).

Steel—"Water Supply and Sewerage" (McGraw-Hill).

NEXT LECTURE—Filtration.

Correction!

A. B. Middleton of the Philadelphia Quartz Co. calls attention to an error in the lecture on "Chemical Handling and Feeding—Part 2". In the September 1955 issue of *Water and Sewage Works*, page 396, section 5-c-(2) second column, second paragraph, line 5, the word "gel" should be changed to "solution".

Frozen Asbestos Cement Pipe Thawed with High-Pressure Steam

by J. ELLIOTT HALE
Superintendent, Kennebec Water District, Waterville, Maine

ONLY a short time after being placed in operation late in November 1954, the new Norridgewock Water District in Norridgewock, Maine, experienced its first freeze-up. It was in an 8-inch asbestos cement main suspended on hangers from the upstream side of the concrete bridge spanning the Kennebec River at this point (see picture). The main is insulated and is provided with a ¾-inch blowoff near each end of the bridge.

Because the system was so new there were only four domestic services receiving water from this line at the time of the freeze-up. The small amount of water used by these services and a sudden drop in temperature caused the line to freeze somewhere along the bridge.

Preparations were made to thaw out the line by first dewatering the remaining sections of pipe between the freeze-up and some gates on the line on which the four services are located. The ¾-inch blowoff was opened to drain this water and then compressed air was forced into the line to drive out the remaining water.

Connection Made to Blowoff

A high-pressure steam "Jenney" operating under steam pressure of 105 pounds per square inch was then connected to the same ¾-inch blowoff and live steam was introduced directly into the 8-inch main.

In about 20 minutes the line was thawed and normal water service was resumed. The ¾-inch blowoff was left open, and although the temperature has gone down much below that when the line froze, the circulation provided by the blowoff has kept this line open.

It is expected that when all the available customers are connected to this end of the system trouble of this nature will not re-occur. In extremely cold weather the ¾-inch blowoff line will again be opened to insure adequate circulation.

INSULATED 8-inch asbestos cement water main being thawed with high-pressure steam introduced through ¾-inch blowoff at end of exposed run

Designing, Constructing and Maintaining

Centrifugal Pumps

Part 9—Mechanical Seals

by ROY CARTER and IGOR J. KARASSIK

Mr. Carter is manager of the Volute Pump Section, and Mr. Karassik is manager of Multistage Pump Section, Centrifugal Pump Division, Worthington Corp., Harrison, N. J. This new series has been prepared by Messrs. Carter and Karassik to review characteristics of centrifugal pumps for water and sewage service.

THE CONVENTIONAL stuffing box of a centrifugal pump is a cylindrical ring formed by four surfaces: the bore of the box, the bottom of the box, the surface of the shaft or shaft sleeve, and the face of the gland. Packing installed in the box, being semi-plastic, when compressed by tightening the gland is squeezed inwardly towards the shaft or shaft sleeve, reducing the clearance between the packing and the rotating shaft or shaft sleeve and thereby reducing the leakage through the box.

Defects of Stuffed Boxes

This reduction in leakage by further compression of the packing can only be carried to a certain point, when the packing will start gripping the shaft. At this point the frictional power increases rapidly, the large amount of heat generated cannot be properly dissipated and the stuffing box fails.

Even before this condition is reached, the shaft sleeve may become worn, scored or grooved. It then becomes impossible to pack the stuffing box satisfactorily.

In other words, a certain amount of leakage is always necessary to lubricate and cool conventional packing. If leakage is severely curtailed or eliminated through overtightening the gland, the packing will fail rapidly.

These characteristics make the use of a semi-plastic packing as a sealing medium undesirable if the leakage is to be held to an absolute minimum under severe pressure conditions. This, in turn, automatically eliminates the axial surfaces as the sealing surfaces, since a semi-plastic packing is the only material which can be made to form about the shaft, compensating for wear.

Another factor which makes stuffing boxes unsatisfactory in certain applications is that many liquids frequently handled today by centrifugal pumps, such as propane or butane, have relatively little lubricating value and actually act as solvents of the lubricants normally used to impregnate the packing. Such services require that seal oil be introduced into the lantern gland of a packed box so as to lubricate the packing and give it reasonable life.

These shortcomings of regular stuffing boxes have encouraged development of an entirely different form of seal using wearing surfaces

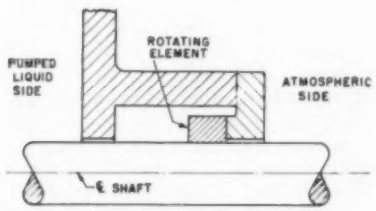


Fig. 1—INTERNAL mechanical seal

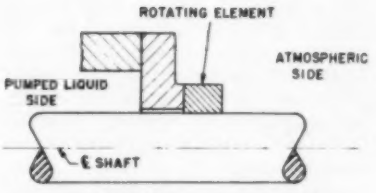


Fig. 2—EXTERNAL mechanical seal

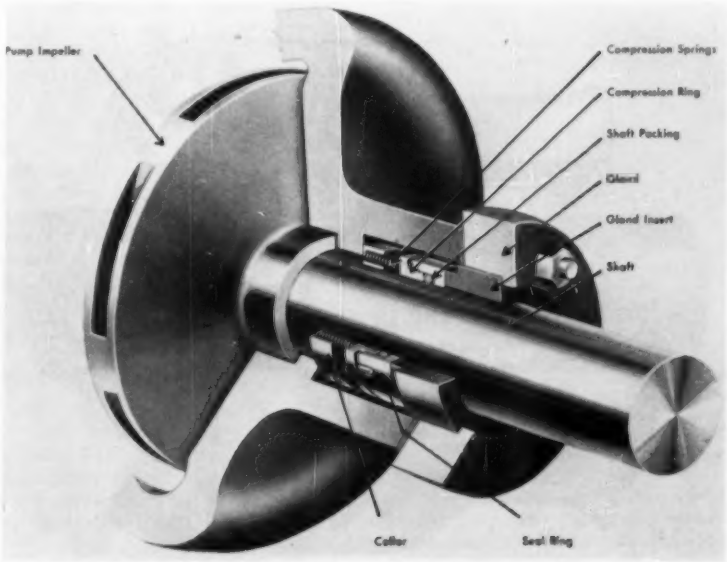


Fig. 3—DURA-SEAL mechanical seal

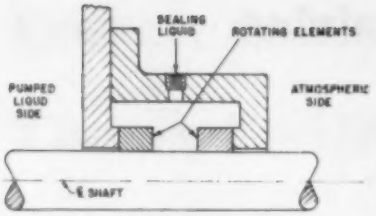


Fig. 4—DOUBLE mechanical seal

other than the rotating axial surface of the shaft and a second stationary axial surface formed by the packing. This form of seal, called the mechanical seal, is a comparatively new development. However, it already has found general acceptance in some pumping fields, particularly those where the shortcomings of packed stuffing boxes made their use undesirable. In fields where the packed boxes gave good service there has been little tendency to replace the packed box with mechanical seals.

Being subject to wear, neither stuffed boxes nor mechanical seals are perfect. For some applications one is better than the other; for other applications the reverse is true. In some fields both give good service and the decision of which to use becomes a matter of personal preference or first cost.

Principles of Mechanical Seal

All mechanical seals, although they differ in various physical respects, are fundamentally the same in principle. In each one, the sealing surfaces are located in a plane perpendicular to the shaft and usually consist of two highly polished surfaces running adjacently, one surface being connected to the shaft and the other to the stationary portion of the pump.

Complete sealing is accomplished at the fixed members. The polished or lapped surfaces are of dissimilar materials and are held in continual contact by a spring. They form a fluid-tight seal between the rotating and stationary members with very small frictional losses. When the seal is new, the leakage past the mechanical seal is so small as to be negligible and can actually be considered as non-existent. Of course, some wear occurs and provision must be made for a very small amount of leakage.

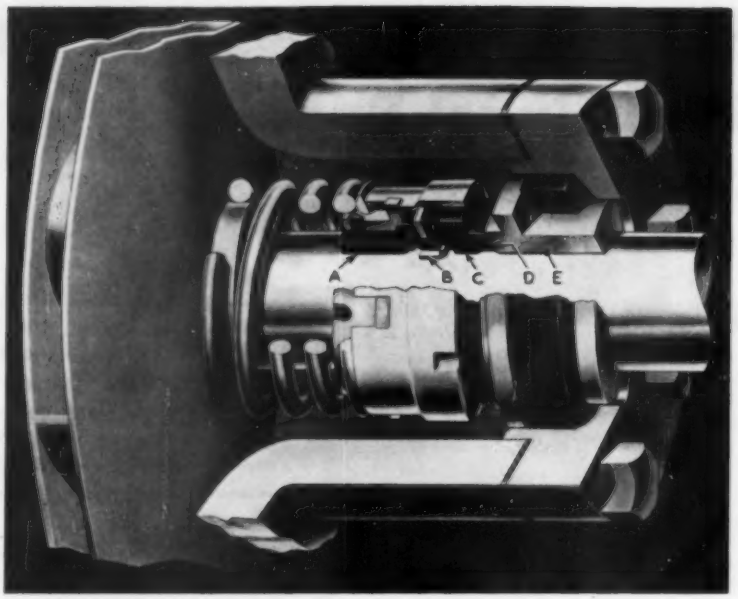


Fig. 5—RUBBER BELLOWS type mechanical seal (John Crane)

The wide variation in seal design stems from the methods used to provide flexibility and to mount the seals. A mechanical seal is similar to a bearing in that it is a close-running clearance with a liquid film between the faces. This film provides some lubrication and cooling which, together with a proper choice of seal face materials, results in very little wear.

Seals for centrifugal pumps do not operate satisfactorily on air or gas; if run "dry", they will fail rapidly. Seals can be used in pumps handling liquids containing solids, as long as provision is made to prevent the solids from getting between the seal faces or interfering with the flexibility of the mounting.

To obtain the pressure breakdown between the internal pressure and the atmospheric pressure outside the pump requires a flow of liquid past the seal faces. This flow, which manifests itself as leakage, may be only a drop every few minutes, or even a haze of escaping vapor (when handling a liquid such as propane, for instance). Thus, even though the leakage is negligible, technically speaking a rotating mechanical seal cannot *entirely* eliminate leakage.

Figs. 1 and 2 show two basic seal arrangements, which differ in rela-

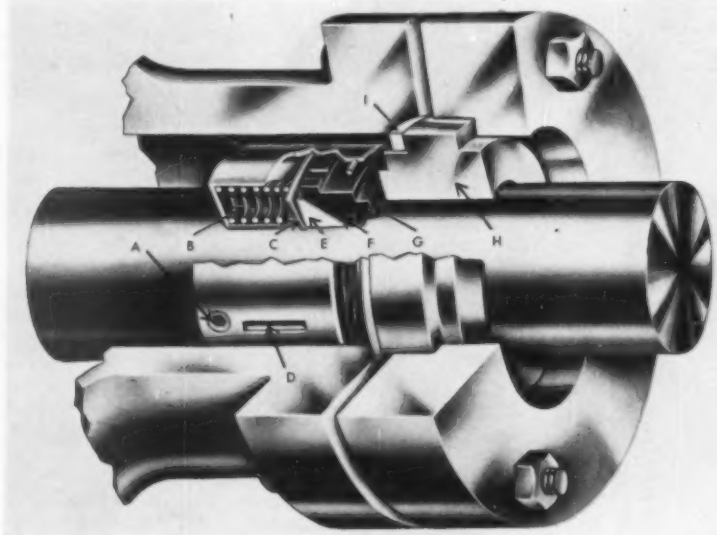


Fig. 6—TEFLON type mechanical seal (John Crane)

tion to the location of the mechanical seal. The internal assembly (Fig. 1) is one where the rotating element is located inside the box and is in contact with the liquid being pumped. When the rotating element is located out of the box (Fig. 2), the seal is an outside arrangement. The pressure of the liquid in the pump tends to force the rotating and stationary faces together with the inside assembly and to force them apart in the external assembly.

The operation of a mechanical seal can best be understood by reference to a few standard commercial units. Therefore, the following discussion treats of the general characteristics of several of the most successful types of mechanical seals. It should be borne in mind, however, that as every pumping problem is different, so is every sealing problem. When positive and dependable results are desired, the mechanical seal should be specifically designed and fitted to the particular unit in question.

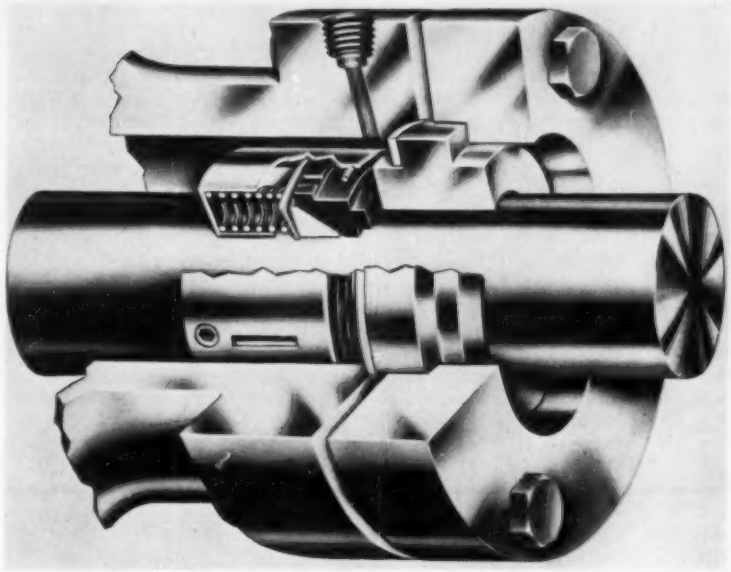


Fig. 7—TEFLON type mechanical seal (John Crane) with connection for liquid lubrication of the seal faces

Typical Construction

The construction of a typical seal is illustrated by Fig. 3. The gland, with the gland insert, is fitted into the casing and constitutes the stationary member of the seal assembly. It provides a seal at two points: first, by means of the gaskets between the gland and the face of the stuffing box, and second, through the contact between the gland insert and the seal ring face.

The mating seal ring with its hardened steel surface rotates with the shaft and is held against the stationary member by the compression ring. The latter supports a nest of springs connected at the opposite end to the collar, which, in turn, is fixed to the shaft. The seal ring is fitted with packing in the shape of an O-ring, which prevents all leakage between the seal ring and the shaft.

It is essential in such a seal that one face be flexibly mounted so as to keep the surfaces in full contact with reasonable shaft deflection. The springs and an ample clearance between the shaft and the seal ring proper accomplish this in the unit illustrated. At the same time, the collar keeps all the other rotating members of the seal in proper position.

The gland insert, which is in contact with the seal ring, is made of antifrictional material. When necessary, it can be designed for lubrication by a liquid other than the liquid pumped.

Two such seals may be mounted inside a stuffing box to make a double seal assembly, as illustrated diagrammatically in Fig. 4. Such an arrangement is frequently used for sealing centrifugal pumps handling abrasive, extremely corrosive, or dangerous liquids.

It may also be used when the pump handles liquids at very high or extremely low temperatures. A cooling or heating liquid is supplied between the two seals at a pressure higher than at the interior of the pump adjacent to the first seal.

Bellows Type

Typical of the spring loaded, synthetic rubber bellows type of mechanical seal, is the seal illustrated in Fig. 5. The tail of the synthetic rubber bellows (A) seals on the shaft; the head is flexible and adjusts automatically for washer wear and shaft end play. The protective ferrule (B) prevents the flexing area of the bellows from sticking to the shaft. The sealing washer (C) has a positive drive through metal parts and seals against the stationary floating seat (E). The two sealing faces (D) are lapped at the factory and provide a seal against leakage.

Teflon Type

For extremely high or extremely low temperature applications (as, for instance, the circulation of very low temperature refrigerant), the bellows seal is not satisfactory. A Teflon type seal manufactured for this type of service is illustrated in Fig. 6. The metal retainer, which is locked to the shaft by set screws (A), provides a positive drive from the shaft to the carbon sealing washer (F) through dents (D), which fit into corresponding washer grooves. The seal between the shaft and the washer is insured by the Teflon wedge ring (E), which is preloaded by the action of multiple springs (B). The spring pressure is uniformly distributed by a metal disc (C). The lapped raised face of the rotating sealing washer mates against the precision lapped face (G) of the stationary seat (H) to provide a positive leakproof seal with minimum running friction between the faces.

The spring pressure keeps the faces in constant contact, providing automatic adjustment for wear and shaft end play. A Teflon ring (I) acts as a static seal between the stationary seat and the end play.

When applied to pumps on vacuum service or operating with a high suction lift, a supply of lubricating liquid is provided through a connection, as shown in Fig. 7. If the liquid pumped is clear, this tap can be connected to the discharge of the pump.

Availability and Limitations

A number of pump manufacturers have lines of single-stage end suction pumps which can be equipped with mechanical seals instead of conventional packing. In many cases, such seals are offered as a standard alternate construction and can be applied to the pumps without any change in machining. A few manufacturers build some sizes of standard pumps

with mechanical seals only, but such a practice makes these pumps less flexible as a line.

Actually, the substitution of mechanical seals for packed stuffing boxes is not always an unmixed blessing. For some services, the mechanical seal is not as desirable as packing. These services include conditions where the liquid pumped tends to form crystals on changes of temperature or on settling.

Another condition which is not favorable for the application of mechanical seals is a service where a pump has long idle periods, when it may even be drained. The flexible materials used in the seal may harden, or a slight rusting occur. Either of these conditions could cause the seal to stick and become damaged on restarting.

Finally, mechanical seals are still subject to failure on occasion and such a failure may be more rapid than that of conventional packing. If packing fails, the pump can generally be kept running by means of temporary adjustment until it is convenient to shut it down. If a mechanical seal fails, the pump must be shut down at once in nearly every case.

Proper application of a mechanical seal is extremely important. Cooling of the seal faces is important for satisfactory seal life and a seal installed inside a pump without a suitably directed flow of liquid for cooling and flushing (to prevent solid material from settling on the springs, for instance) may have an unsatisfactory life.

The mechanical seal has its place in the application of centrifugal pumps as it will, when properly applied under favorable conditions, effectively prevent stuffing box leakage.

Maintenance

Those responsible for maintenance of pumps employing mechanical seals should read carefully the seal manufacturer's instructions for the operation and maintenance of the seal. Based on the service and availability of space pumping equipment, an adequate supply of spare parts should be on hand so the seal can be repaired if it fails.

Allegheny County Sewer Bids Reflect Contractors' Competition

Opening of bids on December 7 for approximately one-third of the construction work involved in the proposed Allegheny County Sanitary Authority project for Pittsburgh and vicinity indicated that the entire project may be built at prices substantially below the $80,000,000 originally estimated for the project.

The bids, for 18.5 miles of interceptor sewers plus two pumping stations and an ejector station, totaled $25,172,800. The estimated cost of this work had been $25,690,800.

If the sharp competition among contractors continues to drive prices down as this would indicate, the Authority is hopeful of paring some $1,500,000 from its cost estimates. This in turn would mean an opportunity to lower the annual sewage rental charge, tentatively set at $15 per household.

The final set of bids, covering the remaining two-thirds of the work, were to be opened December 20.

The work involved in the December 7 bids, together with the apparent low bids, was as follows:

A 6-mile sewer up the left bank of the Allegheny River (Golden Triangle side) from the Point to Negley Run; $10,565,300.

A 3-mile sewer tunneled along the right (north) bank of the Ohio River from the Point to the new Woods Run sewage treatment plant; $8,232,300.

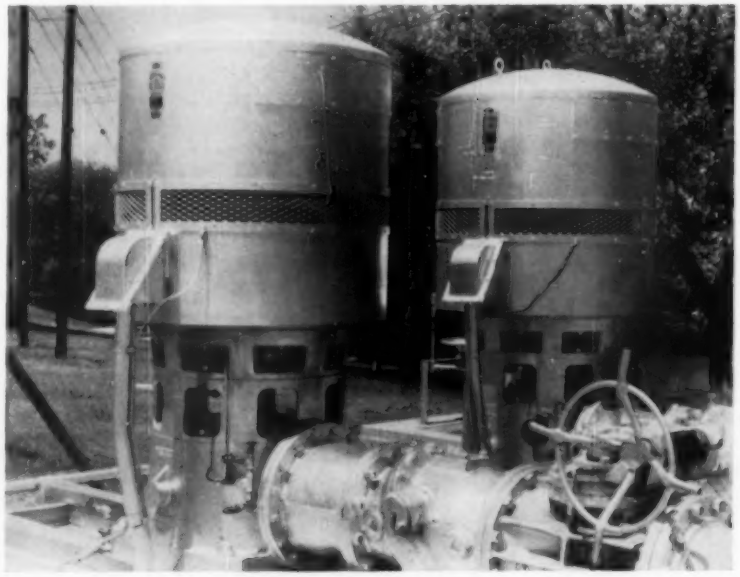
A 3-mile sewer up the right (north) bank of the Allegheny River from the Point to Millvale; $4,226,451.

A 2-mile sewer along the right bank of the Allegheny River from Sharpsburg to Aspinwall, including two river crossings; $1,060,095.

A 1-mile sewer along the right bank of the Ohio River; $304,455.

A 3.5-mile sewer along the Allegheny River from Aspinwall to O'Hara Township and across the river to Verona; $597,411.

Two pumping stations and an ejector station: general contract, $113,765; pumping equipment, $37,345; electrical work, $29,750; plumbing work, $5,700; ventilating work, $2,528.



Corpus Christi Installs Vertical Weather-Protected Pump Motors

Two 450-hp, 1,200-rpm vertical, weather-protected induction motors driving pumps have been put into operation at Corpus Christi, Texas. The pumps are part of the city's water supply system.

Each of the motors is equipped with a steel plate hood for protection against weather. Ventilating air is brought in through screened intakes about half way up the enclosure. Inside the hood it is drawn up several feet and over a baffle arrangement so that dust and moisture particles are dropped out of the air stream before it reaches the inside of the motor. Air is discharged around the bottom.

The motors were built by Electric Machinery Mfg. Company, Minneapolis, Minn., and the pumps by Wintroath Pumps, Inc., Alhambra, Calif.

NEW FROTHLESS activated sludge sewage treatment plant at Gallatin, Tenn.

Gallatin, Tennessee's New Sewage Treatment Plant

Frothless activated sludge treatment for 1.5 mgd plus 100 per cent expansion

by CECIL G. ACREE

Mr. Acree is Design Engineer with J. Sanders Parker, Consulting Engineer, Nashville, Tenn. In this article he describes the simple design feature that permitted placing the plant in operation without frothing troubles.

FROTH, the nightmare of the activated sludge type sewage treatment plant, has been successfully eliminated in the new plant at Gallatin, Tennessee. This was accomplished by means of spray rails strategically located along the sides of the aeration basins.

The spray rails consist of a series of nozzles spaced 12 inches on centers, located approximately 18 inches above the water surface on the opposite side of the basin from the air diffusers. These nozzles emit a cone-shaped overlapping spray pattern that does a very satisfactory job of keeping the froth suppressed.

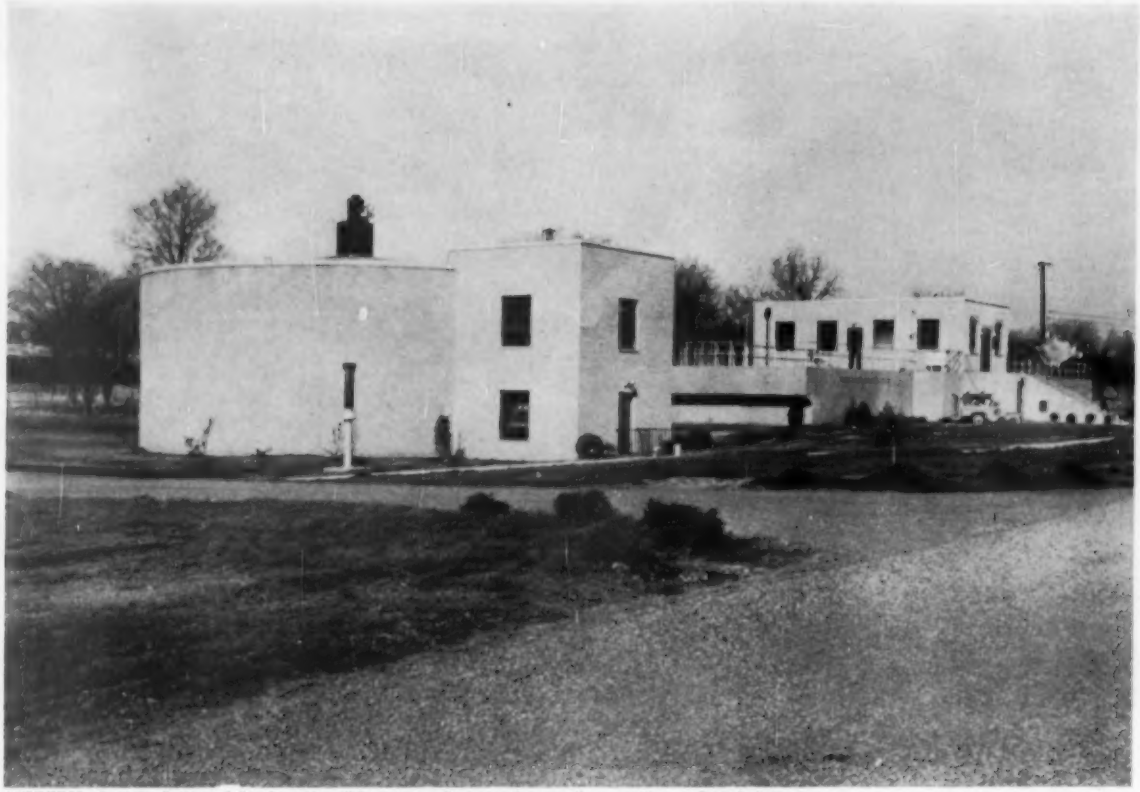
The water for the spray rails is supplied by means of a service pump that takes its suction from the chlorine contact chamber just ahead of the point where the effluent is discharged to the receiving stream.

The firm of J. Sanders Parker, Consulting Engineer, was retained to conduct an engineering study of the present and future water and sewerage needs of the City of Gallatin. A report of this study was submitted to the city in March 1954.

As a result of this report, a bond referendum was held and the citizens authorized a $1,000,000 revenue bond sale with a general obligation guarantee. The $1,000,000 was spent on additions to the water distribution system, the sewage collection system, the water treatment plant, and construction of a new sewage treatment plant.

The total construction cost of the sewage treatment plant, including one lift station, was $327,367.64.

Gallatin's original sewage treatment plant was constructed in the



MODERN plant is designed for functional beauty and convenience of operation and maintenance

1930's. The city has since outgrown the plant to such an extent that abandonment of the old plant and site was necessary. A new site approximately 1,000 feet from the old plant, adjacent to the town creek, and containing approximately five acres of land, was selected for the location of the new sewage treatment plant.

It is interesting to note that the City of Gallatin purchased a strip of land adjoining the new sewage treatment plant site to be reserved for industrial development. Prior to the completion of the sewage treatment plant, two new industries had already become neighbors. A furniture factory was constructed and is now producing fine furniture. A garment factory is near completion and ready for operation. This tends to confirm the oft-spoken axiom that for a town to grow, the basic utilities (water and sewerage) must stay ahead at all times.

CONTROL PANEL as viewed from office gives complete picture of push buttons and signal lights

Plant Description

Gallatin's sewage treatment plant is of the activated sludge type. It is designed for a capacity of 1.5 mgd, with provision for 100 per cent expansion of the plant. The design capacity was established to take care of a considerable amount of infiltration in the existing sewage collection system.

The plant in general consists of a comminuting chamber, a main pumping station located at the sewage treatment plant and actually a part of the main structure, together with primary and secondary settling basins, aeration basins, a chlorine contact chamber, a control building, sludge beds, a digester and a digester control building.

The main structure of the plant is composed of a central building called the main control building that houses

the pumps, compressors, laboratory, rest room, and tube cleaning room. This control building, located in the center of the main structure, is surrounded on three sides by the primary clarifiers, the aeration basins, and the final clarifiers and chlorine contact chamber. The use of common walls between the various basins has resulted in considerable savings in volume of concrete, and resulting cost savings.

The chlorinator room is located on the front of the main structure with a separate outside entrance. This isolates any possible chlorine fumes from the rest of the control building.

The digester and digester control building are located together in a separate structure isolated from the main structure. The digester is of the floating cover type and is externally heated by means of a gas-fired boiler. The sludge beds are divided into four separate units.

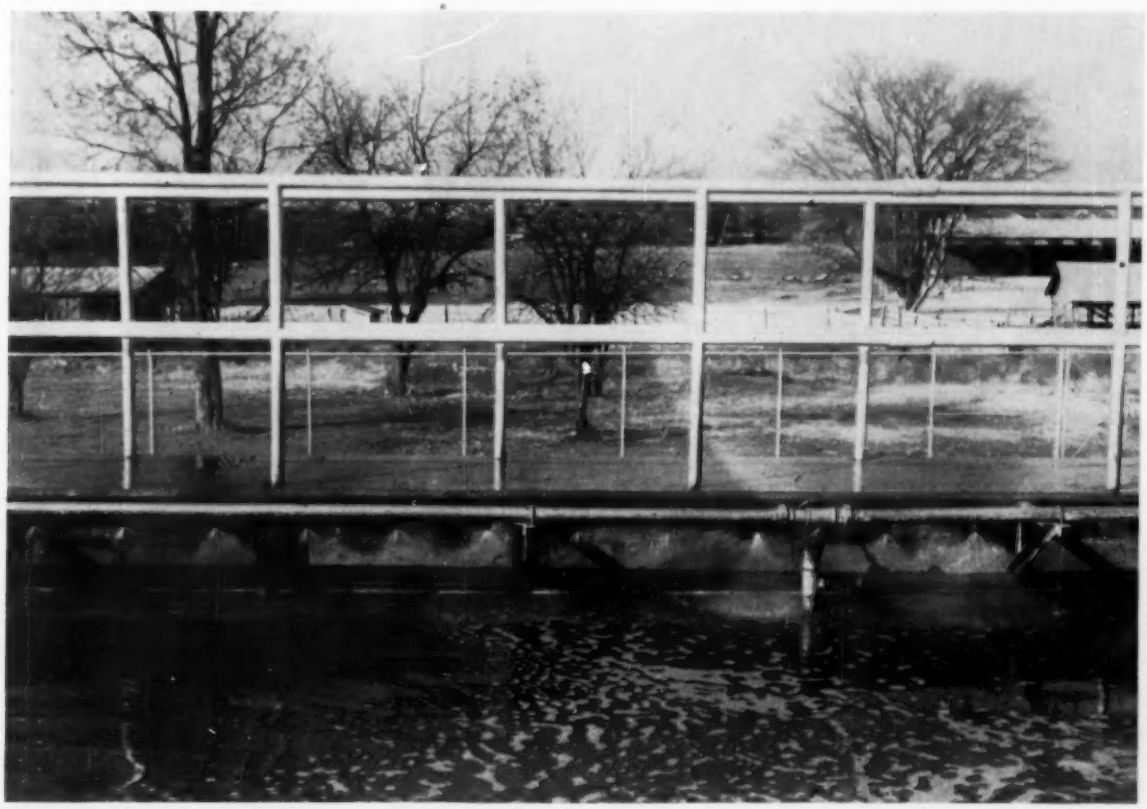
AERATOR in operation shows froth control system success (left); out-of-service unit (right) shows simple piping arrangement

Various Plant Details

Sewage from the entire town is collected and brought to a main manhole located directly in front of the sewage treatment plant. All the sewage flows by gravity to this main manhole with the exception of one small area that requires a pumping station.

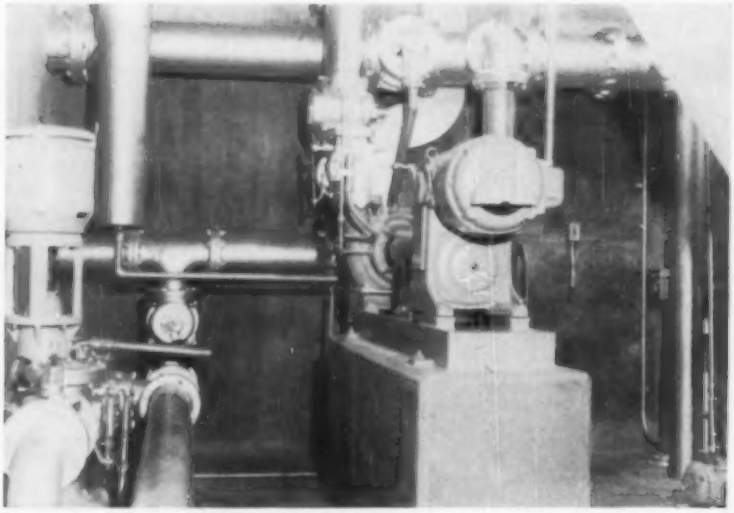
The invert elevation of this receiving manhole is actually below the elevation of the town creek. This necessitates a main pumping station located at the plant site for lifting the sewage to an elevation that enables it to flow through the plant.

The sewage flows from the main collection manhole to a comminutor chamber that serves as a wet well for the main pumping station. This chamber is equipped with a by-pass and bar



SPRAY RAIL on aeration tank suppresses froth economically

DIGESTER and digester control building are functional, architecturally clean, and pleasingly landscaped



SERVICE pump (left) and return sludge pump (right)

screen that can be utilized in case of failure of the comminutor mechanism. The comminutor chamber is actually a part of the main pumping station wet well, the main pumping station itself being part of the main control building structure. The dry well of the main pumping station is located adjacent to the wet well of the comminutor chamber so that the pumps take their suction directly from the wet well. It is necessary to lift the sewage approximately 25 feet in the pump station to an elevation that permits it to flow through the treatment plant by gravity.

Pump Controls

To minimize surges through the sewage treatment plant, a system of sequence control for pump operation has been utilized. All of the sewage is handled by three vertical, centrifugal-type, non-clog pumps with capacities of 500, 750 and 1,000 gallons per minute, respectively.

The sequence control is actuated by means of a float located in the wet well. When the level of the liquid in the wet well rises, the 500-gpm pump starts operation. If the level continues to rise, the 750-gpm pump comes into operation and the 500-gpm unit ceases to operate. If the 750-gpm pump cannot handle the flow and the water level continues to rise in the wet well, the 1,000-gpm pump starts operation and the 750-gpm pump goes off. If the level continues to rise, the pumps automatically operate in varying combinations to give flows of 1,250, 1,500, 1,750 and 2,250 gpm.

This method of sequence control maintains a relatively smooth flow through the plant and closely approximates the actual flow to the plant.

The effluent from the pumping station goes immediately to an aerated flume that conveys the sewage by gravity to the inlets of the primary settling basins. The primary settling portion of the plant is divided into two identical rectangular chambers. The detention of these tanks is 1.5 hours at the rated capacity.

These primary settling tanks are equipped with straightline sludge removal equipment, with collection hoppers located on the influent end of the basins. The primary sludge, together with any wasted activated sludge, is removed periodically by gravity from the collection hoppers to a main hopper. It is then pumped to the digester by means of a raw sludge pump located in the main control building. The effluent from the primary settling basins flows over three weirs at the end of the chambers into another aerated flume, by which it is transported to the inlets to the aeration basins.

The aeration portion of the plant is divided into two units of equal capacity. These tanks have a detention time of 6 hours at the rated capacity and operate on the tapered aeration principle; that is, the rate of aeration is decreased as the mixed liquor flows through the aeration basins.

Saran-wrapped tubes are used for the diffusion of the air to the tanks. These tubes are spaced along headers mounted on individual swing pipes that can be raised by means of a portable pneumatic-driven hoist for easy access and removal of tubes for cleaning purposes. The swing-type diffusers are located on the center wall between the two aeration tanks.

Effluent from the aeration tanks flows over a weir at the end of each basin into an aerated flume that carries the mixed liquor to the inlets of the final settling basins.

Final Settling Basins

The rectangular final settling basins have a detention time of 2.2 hours at the rated capacity of the plant. Secondary sludge is removed from the basins by means of straightline sludge removal equipment. The sludge is collected in hoppers at the end of the settling basins and is drawn off continuously from each hopper by individual draw-off valves of the adjustable telescoping type.

The individual draw-off valves discharge into a central trough that con-

veys the return sludge by gravity to a collection hopper. The return sludge is pumped to a sludge division box by means of a variable speed pump. The return sludge can be divided into two parts and any percentage desired can be wasted by returning to the primary tanks that portion to be wasted. This wasted sludge settles out in the primary tank and is sent to the digester along with the primary or raw sludge.

Effluent from the final settling basins is drawn off by means of four weir troughs spaced over the last two-thirds of the tanks. These weir troughs are connected to a flume alongside one of the final basins and so arranged that the discharge can be through a chlorine contact chamber under the flume or directly to the outfall sewer and the receiving stream.

Chlorine Contact Chamber

Effluent from the final settling basin enters a chlorine contact chamber that has a detention time of 15 minutes. The effluent from the chlorine contact chamber is discharged over a 90° V-notch weir. The rate of flow of the effluent over the weir is recorded in million gallons per day on a striptype chart located in the office of the control building.

Control Building

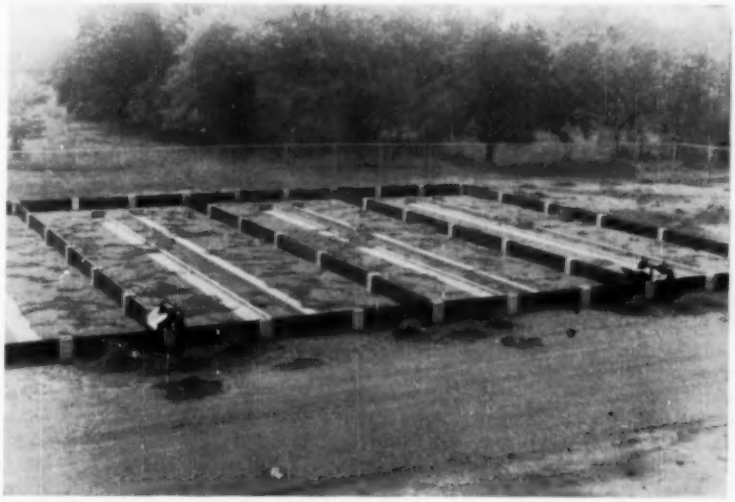
In the control building is an office situated so that the operator can observe the operating panel board and determine from pilot lights each electrical motor that is running. The office is located next to the laboratory, which contains all the necessary equipment to make tests for dissolved oxygen, relative stability, pH, 5-day B.O.D., and suspended solids. There is also a tube cleaning room that contains space enough and equipment for properly cleaning the aerator tubes and for performing routine shop work. A locker room with toilet facilities is provided for the convenience of the operators. The entire basement portion of the control building houses all the pumps, compressors, air filters and piping for the operation of the plant.

Sludge Beds and Yard Piping

The sludge beds, of the usual sand type with gravel under layer, have a farm tile underdrain system. Concrete runways permit of driving a truck into the sludge beds for easy one-move cleaning. The walls of the sludge beds consist of creosoted lumber held in place by concrete posts.

The yard piping is so arranged that in the event of a complete power failure the sewage will automatically by-pass the treatment plant. Provision is made for by-passing any particular portion of the plant or by-passing the entire plant.

PLEASANT, well-equipped plant laboratory is conducive to good control analysis work



SLUDGE drying beds are equipped with tipping inlet troughs, concrete truck runways, and operational flexibility through size adjustment possibilities

The present population of Gallatin is slightly in excess of 6,000 people. In addition there are a number of industries, including a branch factory of a large shoe corporation, a branch factory of a large cheese manufacturing corporation, a large tobacco manufacturing plant, a large lock manufacturing company, and several smaller manufacturing and fabricating plants. The Tennessee Valley Authority is in the process of constructing a large steam generating plant near Gallatin. The industrial growth of Gallatin necessitated the adoption of the program of expansion for the water and sewerage systems.

Equipment Suppliers and Contractors

Comminutor equipment, swing diffusers, secondary sludge drawoff equipment, sludge division box, floating cover and pumps were furnished by the Chicago Pump Company. Primary and secondary sludge removing equipment was furnished by Chain Belt Company. The digester heater was manufactured by Cyclotherm Division of United States Radiator Corporation.

Bush Building Company of Nashville, Tenn., was the general contractor on the construction of the sewage treatment plant. Albert O. Heindryckx was resident engineer and the author was design engineer on the project for J. Sanders Parker, Consulting Engineer.

The Membrane Filter: Advantages and Disadvantages

As revealed during almost four years of experience by the Los Angeles County Sanitation Districts

by A M RAWN and F. R. BOWERMAN

Mr. Rawn, a Past-President of the Federation of Sewage and Industrial Wastes Associations and long-time Editorial Associate of this magazine, is Chief Engineer and General Manager of the Los Angeles County Sanitation Districts. Mr. Bowerman is Division Engineer.

IN RECENT ISSUES of *Water and Sewage Works* have appeared articles discussing the membrane filter technique for determination of bacterial counts.

One article dealt with the membrane filter in terms of its significance as a simple and accurate means of improving water analysis. Another discussed some supposed inadequacies dealing with the testing of potable waters and tidal bathing areas.

This paper proposes to relate certain experience gained during several years use of the membrane filter, in the hope that it will shed additional light on the subject.

It is certainly correct to note that there are shortcomings in the present state of development of the membrane filter technique. Indeed, most of the articles on the subject have been exceedingly fair and conservative in evaluating the potentialities of this new laboratory tool. One of the best summaries of the advantages and disadvantages of membrane filters for water potability control is contained in a recent report by Thomas, Woodward, and Kabler[1].

Some Objections: Some Facts

With respect to potable waters, objections from some are that large volumes of water must be filtered, that large sample bottles must be used, and that these are impractical for large-scale field sampling and for refrigeration during transportation.

There is no reason why a sample for an MF determination need be any larger than one for lactose-broth inoculation if comparable precision is sought.

Thus, if a 50-ml portion of water contains exactly one coliform, one of the five 10-ml portions in lactose broth will be positive. In comparison, if the 50-ml sample is tested by the MF technique, one sheen colony will be produced. The MPN by the present standard method will be 2.2 per 100 ml (or 10 per cent in error), whereas the MF result will be exactly 2 per 100 ml.

Suppose the 50-ml sample contained exactly 2 coliforms. Both could end up in the same 10-ml lactose tube, giving an MPN of only 2.2 per 100 ml, or 45 per cent in error. On the other hand, the MF would (barring coalescence) still show two colonies, and the count will be 4 per 100 ml, or no error.

A thorough statistical comparison of MPN and MF results is given by Thomas and Woodward[2]. They show that one of the major advantages of the MF technique is the increased precision made possible by filtration of large quantities of water. This advantage in no way detracts from precision in the analysis of equal volumes of water by either method. Hence it is not *necessary* to take larger samples for MF testing, although to do so will lead to improved precision.

In deprecating large samples for field testing and in mentioning difficulties with refrigeration and transportation, one of the unique advantages of membrane filters is emphasized. This new technique lends itself admirably to field testing. Portable laboratories are available commercially (and can be improvised readily) which enable the technician to filter and incubate a sample within a few minutes after it is taken.

Or, the sample can be filtered only and the MF shipped to the laboratory on a preservative medium at ambient temperatures. This procedure is reported by Geldreich, Kabler, *et al*[3] to give results comparable to the MPN test on refrigerated samples examined after 24 hours, and results better than those for unrefrigerated samples.

The Question of Costs

The cost of membrane filters is sometimes cited as a disadvantage. The contention that the cost of materials for an MF test is greater than that of media required for an MPN determination is certainly correct; however, the labor factor and the savings in glassware are overlooked.

In their report, Thomas, Woodward and Kabler[1] state: "The cost of the membranes should decrease substantially as they come into more common use. Moreover, the shorter technician time per test with the MF procedure actually results in an overall cost reduction."

There is no question but that the streamlined MF technique requires less labor per sample than the MPN procedure, and in today's laboratories labor is the major factor in cost.

It is interesting to note in this respect that the adoption of membrane filters in Germany during World War II was brought on largely by the exigencies resulting from mass bombings and the shortage of trained laboratory personnel. With glassware shattered, and incubators at a premium, health departments of several cities such as Hamburg and Stuttgart found true economies of equipment and labor in the MF procedure.

In the testing of non-potable waters the Los Angeles County Sanitation Districts have conducted bacteriologi-

cal surveys of littoral ocean waters nearby their sewer outfall for over 20 years and have made parallel tests with the membrane filter since early in 1952. To date the Districts have performed over 8,000 membrane filter tests under field conditions and have had ample opportunity to compare labor and material requirements for both lactose fermentation tests and membrane filter tests.

Early results of the testing procedure were outlined in a paper by Goetz, Gilman and Rawn[4]. Later findings have verified the conclusion that more than four times as many hours are required in the laboratory preparing media, tubes and pipettes, reading tubes, transferring inoculations, and washing tubes for the lactose fermentation (MPN) procedure as are required for the same number of tests using the membrane filter.

Additionally, it has proved necessary to use some three to four times the number of pieces of glassware and equipment for the lactose fermentation tests as for the membrane filter techniques. These are based on MPN determination by two parallel four-step dilutions with subsequent confirmation, compared with the membrane filter using an initial enrichment nutrient followed by transfer to Endo's medium.

L. A. County San. Distr. Experience

Field inoculation of lactose tubes has long been practiced by the Districts to obviate the necessity for refrigeration of samples and to avoid additional laboratory work subsequent to the day's testing. Sometimes field inoculation on a pitching, tossing boat on the not too peaceful Pacific Ocean has tested the dexterity and skill of the technician. In fact, on some occasions field inoculation has been impossible.

The membrane filter technique has proved much simpler under such adverse conditions; and glassware breakage, with subsequent loss of samples, has been almost entirely eliminated.

Early testing revealed that some judgment must be exercised by the sampling technician to determine the size of sample most apt to yield a readable count on the membrane filter. This proved no problem when sampling routinely in an area where the approximate concentrations of sewage in sea water may be estimated from experience.

Present procedure is to filter a 10-ml sample within an area of about one mile from the point of outfall discharge, with a 25-ml sample being filtered at all other sampling points.

No necessity for taking decimal dilutions in order to read coliform densities on the membrane filter has proved necessary subsequent to adoption of this sampling technique. Because of the extremely wide range of numbers which can be counted on the membrane filter, it is probable that no more than two widely differing dilutions need be measured on the membrane filter for non-potable waters, unless such waters approach concentrations of bacteria found in crude sewage.

Controversial Aspects

The most controversial aspect of the membrane filter still remains the bacteriological significance of the membrane filter technique using Endo's medium as compared with the lactose fermentation (MPN) test. The Sanitation Districts' fairly lengthy history of parallel testing since early 1952 reveals certain numerical similarities, while, at the same time, revealing some perplexing anomalies.

The question is still considered moot as to whether the *same* organisms are counted in the two tests. There is strong evidence that the membrane filter is selective for *E. coli* in sewage-sea water mixtures, particularly if the coliform organisms have been exposed to the ocean environment for several hours. Since *E. coli* are the particular coliforms considered most representative of pathogen viability, it seems reasonable to say that the selectivity of the membrane filter with respect to *E. coli* is a point in its favor as an indicator of sewage pollution. Additional study will verify or deny this conclusion.

In the meantime, it can be said that the simplicity, ease, convenience, precision, and speed with which the membrane filter test is completed, and meaningful bacteriological levels obtained, have been clearly demonstrated in the field and in the laboratory through almost four years of routine testing by the Los Angeles County Sanitation Districts.

References

1. Thomas, Harold A., Jr., Woodward, Richard L., and Kabler, Paul W., "Water Potability Control With Membrane Filters." A Report of the Sub-Committees on Waste Disposal and Water Supply of the Committee on Sanitary Engineering and Environment, National Research Council (Oct. 7, 1955).

2. Thomas, Harold A., Jr., and Woodward, Richard L., "Estimation of Coliform Density by the Membrane Filter and the Fermentation Tube Methods." Amer. Jour. Pub. Heatlh, *45* (Nov. 1955).

3. Geldreich, E. E., Kabler, P. W., Jeter, H. L., and Clark, H. F., "A Delayed Incubation Membrane Filter Test for Coliform Bacteria in Water." Amer. Jour. Pub. Health, *45* (Nov. 1955).

4. Goetz, Alexander, Gilman, R. H., and Rawn, A M, "Application of Molecular Filter Membranes to Specific Problems in Water Analyses." Jour. Amer. Water Works Assn., *44* (June 1952).

A. M. Buswell Retires as Head of Illinois Water Survey

Joins Staff of Dept. of Chemistry, University of Florida

Dr. Arthur M. Buswell retired recently as Chief of the Illinois State Water Survey, which he has headed since 1920.

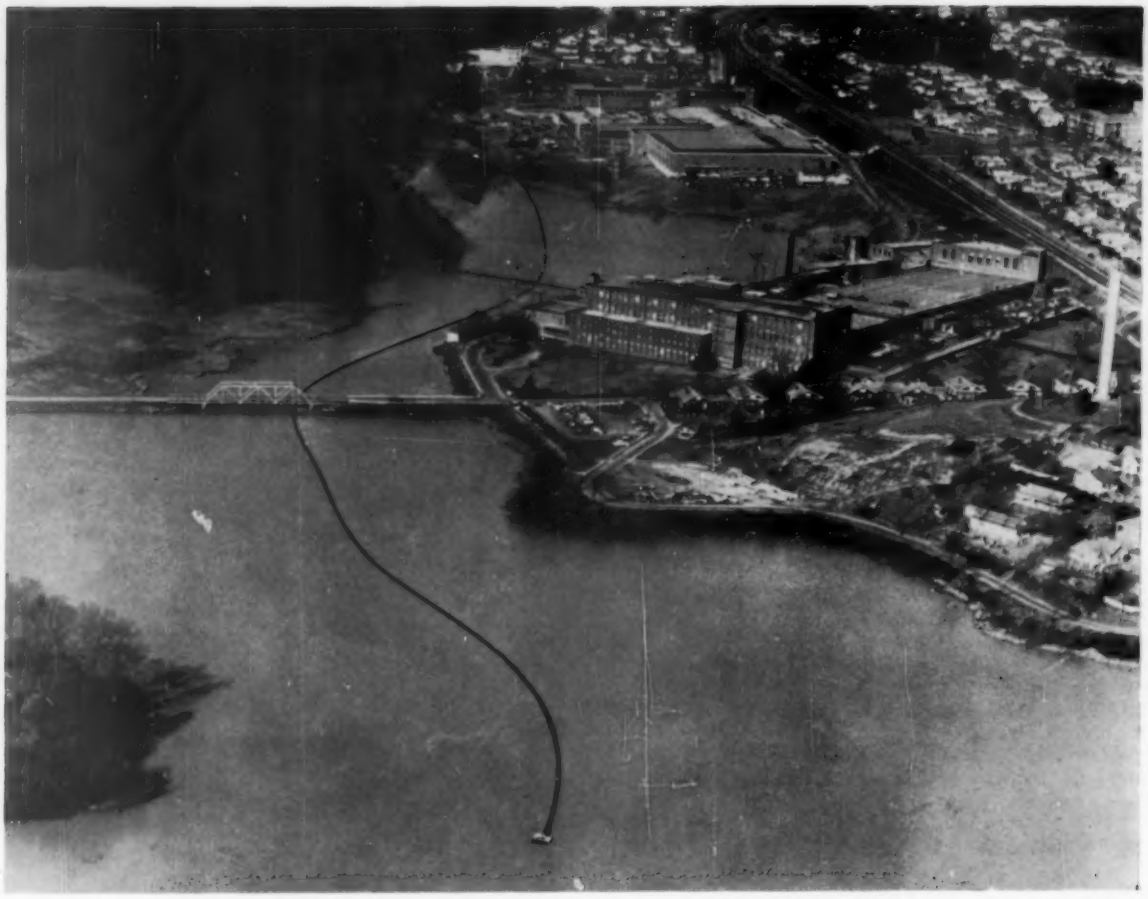
Under his leadership the Survey has developed into one of the largest units of its kind in this country, with a staff of 58 scientists and technicians. As yet no one has been appointed to the permanent position, temporary assignment being made from within the Survey staff.

Dr. Buswell's work has been in the entire field of water supply and quality control, including sewage and industrial waste treatment, particularly as regards sludge digestion and by-product reclamation. He also has been very active in process research in the fermentation industries, and in radar tracking of rain and snow storms as a means of local area weather prediction and precipitation forecasting for water supply and flood control. More than 100 bulletins and circulars have been published by him or under his direction.

Dr. Buswell has moved to Gainesville, Fla., where he has accepted an appointment as Research Professor in the Department of Chemistry, University of Florida. In this assignment he will participate in an expanded program of water research in that Department.

Observing many kinds of people, over many years, I find the strongest, most competent and reliable man is also the first to admit his inadequacy . . .

Contradictory as it may sound, he is strong because he is humble.—*J. Edgar Hoover.*



3,100 FEET of 24-inch asbestos-bonded pipe floating on lake at Cramerton, N. C.

An Inexpensive Underwater Effluent Line

Assembled on lake shore and floated into position

by W. E. McFEE

Supervisor of Product Information Service, Armco Drainage & Metal Products, Inc., Middletown, Ohio.

THE Cramerton, N. C., plant of Burlington Industries, Inc., had for some years been discharging the effluent from the dye plant into the municipal sanitary sewer system. The dye waste overtaxed the system causing manholes to over-flow.

To relieve this condition, it was decided that the proper solution would be to carry the effluent from the dye plant 3,720 feet to the channel of the river, where there was a steady flow of water that would dissipate any discoloration created by the dye wastes.

The laying of a 24-inch pipeline carrying the effluent from the dye plant for a distance of 500 feet underground and 3,220 feet underwater was not a new problem for the mill engineers. Several years ago engineers of Armco Drainage & Metal Products, Inc., had helped Burlington Industries solve a similar problem at that company's Dublin, Va., plant. This first installation had proved successful and Armco again was asked to assist in engineering the line for the Cramerton plant.

The first 500 feet of the line was installed underground from the dye plant to the edge of the water. The remaining 3,220 feet rests on the bottom of the lake.

That part of the line leading from the dye plant to the water's edge is Armco 24-inch asbestos-bonded pipe, asphalt coated and quarter-paved; the portion under water is simply coated. Paving was unnecessary in the line resting on the bottom of the lake because it will be running full at all times and the velocity of flow will be so low that there will be no erosion problem.

18-ft Lengths Assembled on Shore

The entire underwater line was assembled in 18-foot lengths on shore and pushed out into the water as each

joint was made. The open end of the first pipe was fitted with a watertight wooden plug, as a safety measure, and supported on a wooden raft to keep it above water. All joints were made with 2-foot one-piece bands and six threaded rod hoops. The ends of these rod hoops were passed through "tex" lugs and drawn up tightly with standard nuts.

To insure watertight joints, the asphalt coating was heated with a blow torch at the point where the pipe fits under the end corrugations of the bands. The asphalt then flowed slightly under pressure of tightening. The torch was used again after the joint was made up to insure a tight seal.

Used motor oil was wiped over the entire area of the pipe under the bands to facilitate the band sliding over the pipe as it was drawn up tight. All nuts were tightened with an air-operated wrench. Although the line floated on the water for more than three weeks before the assembly was completed, no serious leaks developed.

PUSHING the line, length by length, into the lake before making successive joints

Easy to Push

Even when more than 3,000 feet of pipe was floating on the water, it was a simple matter for four men on shore to push the line farther into the lake as each new 18-foot section was added. In a normal 8-hour working day it was possible for a foreman, a crane operator and seven laborers to join and float into the lake from 360 to 400 linear feet of pipe. An additional man in a boat guided the forward end of the pipe and adjusted guy wires to keep the line in proper position. When the entire line was assembled, it was guided into proper position and the forward end unplugged. This permitted water to enter the pipe and sink it into position, completing the installation.

EFFLUENT pipeline held in position by guy lines before being sunk into place on lake bottom by controlled air release

Details of the procedure for laying the pipe were devised by the contractor on the job, John V. Barger and Company, of Mooresville, N. C.

Installing a test plug in the line

Recent Advances in Sludge Digestion

The Second of a Series

by THEODORE JAFFE

Mr. Jaffe is Associate Professor of Civil Engineering, Sanitary Research Laboratory, University of Florida, Gainesville, Fla. This is one of a series of articles written by Professor Jaffe for the practical sewage treatment plant operator.

THE material removed from sewage as solids (except grit) is called sludge. These solids may be readily settleable from the raw sewage, and if so may be removed in primary sedimentation tanks; they may need the coagulating action given by chemical treatment before settling in secondary sedimentation tanks; or they may be dissolved or colloidal particles that require the action of biological slimes before removal, as in trickling filters or activated sludge.

Need for Digestion

A method of further treatment of these solids must be available, as they still contain large amounts of water and organic material and cannot be disposed of in this condition. This organic material if not further treated will cause unpleasant odors due to bacterial action. Since bacteria will use the sludge as food, it is common practice in sewage works to control this feeding of the bacteria, and the "dining room" facilities furnished are called sludge digestion tanks.

In these digestion tanks, the bacteria are made to work for the plant operator so as to reduce the sludge to a smaller volume by dewatering, and to reduce odors by forming mineral matter from the organic compounds. The operator must keep the bacteria happy by controlling the amounts of food fed, the pH, and the temperature, among other things.

These bacteria have one other important need—there must be no atmospheric oxygen in their homes, since sludge digestion as practiced today is an anaerobic process. In anaerobic digestion, the bacteria break down the organic solids to obtain the oxygen required for their respiration.

In return for furnishing the bacteria with homes and food, the operator is rewarded—in addition to the reductions in volume and odors—with gases of different sorts. One of these gases, methane, can be used as a fuel to reduce the operating costs of the plant. These, then, are the major reasons for digesting sewage sludge.

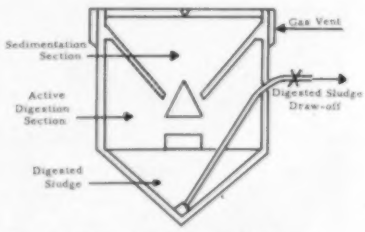


Fig. 1—END view of an Imhoff tank

Sewage sludge may be digested in any of the several types of tanks. Perhaps the oldest type of plant-size tank is the Imhoff tank. This two-story tank consists of a primary sedimentation compartment for the upper story, through the bottom of which the settled solids fall into the lower story, the digestion chamber (Fig. 1).

Most plants today have separate

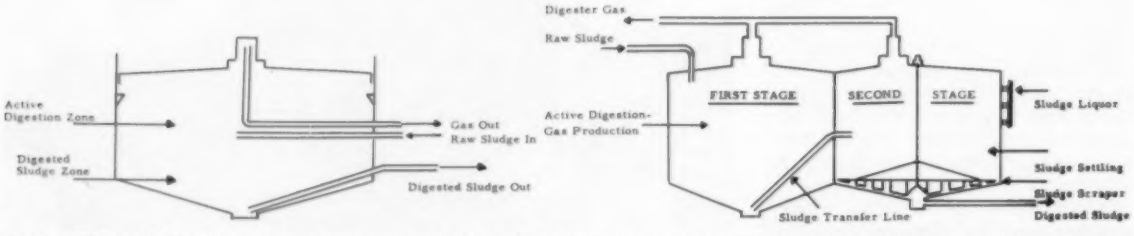


Fig. 2—SCHEMATIC cross-sections of single-stage (left) and two-stage (right) digesters, showing simplified piping and gas collection

sludge digesters. These may be covered units from which the gas may be collected and utilized, or open (uncovered) digesters from which the gases escape to the atmosphere. Separate digesters may be used for single-stage operation where the digestion takes place entirely in one tank (Fig. 2a), or they may be operated as two-stage digesters (Fig. 2b).

Two-stage operation consists of two or more tanks, the first of which is usually heated and covered for gas collection. Sludge liquor (supernatant) is not customarily drawn from this first stage. After gas production has reached its peak in the first-stage tank (about 20 to 25 days) the sludge is pumped into the second stage, where settling of the digested sludge and clarification of the sludge liquor occur.

Current practices in sludge digestion are fairly well standardized, although the actual details may vary slightly from plant to plant. Sludge digestion tanks are usually kept within one of two temperature ranges. The majority are kept within the mesophilic range at about 100°F. Sludge can also be digested in a thermophilic range with the optimum temperature at about 130°F. Although the higher temperature results in faster digestion, and usually a more uniform rate of gas production, these advantages may be offset by odor and operating difficulties. Therefore, this method of operation is seldom practiced.

To maintain digestion temperatures around 90° to 100°F, or higher, requires some method of heating. In many plants this heating system is a source of trouble to the operator. However, heating a digester decreases digestion time considerably. For example, at 100°F the usual period for keeping sludge in the digester is 3 to 4 weeks, whereas at 60°F the time increases to about 2 months. The time-temperature relationship is shown in Fig. 3.

The heating of sludge digesters is usually accomplished by means of submerged coils, either along the walls of the digester or set off from the walls within the sludge mass. By passing hot water through the coil, the sludge in contact with the outer surface of the coil becomes heated. One of the chief disadvantages of this method of heating is the tendency of the sludge to cake on the coils[1,2]. When this happens, less heat is transferred to the liquid sludge. This sludge cake tends to increase in thickness as time goes on, making matters worse. Some plants have also reported serious corrosion problems[3,4].

Aims of Research

Research work on sludge digestion has had four prime objectives: (a) to increase gas production; (b) to produce a more compact, better digested sludge; (c) to reduce the retention time in the digester (thus allowing use of smaller, less expensive units); and (d) to simplify operation and maintenance.

Pittsburgh System

One of the more interesting of the new sludge treatment methods of recent years is that to be used in the treatment plant for Pittsburgh, Pa.[5] Although not yet constructed, it has been designed on the basis of laboratory and pilot plant work. This plant will employ a biological system for sludge thickening, followed by incineration of the wet sludge. It should be noted that sludge incineration (as well as the entire scheme) is particularly suitable to the Pittsburgh site, because of the relatively low fuel costs in that area.

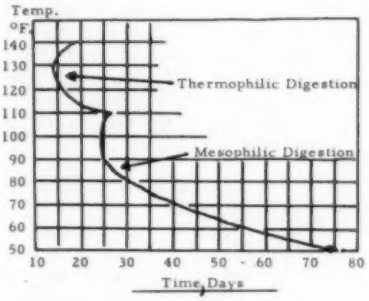


Fig. 3—TIME required for 90 per cent digestion of plain sedimentation primary sludge at different temperatures

The incineration of wet sludge has long been held feasible. As early as 1945 Schroepfer concluded from some studies that, if the moisture content of sludge could be reduced to 85 to 90 per cent, incineration of the liquid sludge could be economically accomplished[6]. The problem was to obtain a concentration of the sludge to a 10 to 15 per cent solids content.

To concentrate the raw sludge at Pittsburgh, it is passed through a heat exchanger until the sludge reaches 95°F. From here, the sludge passes into the concentration tanks, also at 95°F. In these units, biological action takes place, and maximum concentration of the solids occurs at the end of 120 hours. The solids content of the sludge at this point is 18 to 20 per cent or more, having started with a raw sludge of 3.5 to 4.5 per cent solids.

It is interesting to note that the sludge solids in this process settle upwards, due to the gases produced by the microorganisms, and the liquid portion forms below within 48 hours. The subnatant (contrasted to supernatant) liquor is drawn off first. The concentrated wet sludge then will be drawn to the incinerator. Laboon's study[5] showed that this concentrated sludge could be dewatered on vacuum filters or digested further.

As with most untried systems, actual operation of the plant when it is completed may introduce unforeseen difficulties. At present, pilot plant operation has shown that raw sludge can be concentrated to about 18 or 20 per cent solids in a relatively short time. The subnatant liquor is comparatively low in B.O.D. and solids. This concentrated wet sludge may be disposed of by incineration, vacuum filtration, or further digestion.

On the other hand, gas production is extremely low; pumping of the concentrated sludge requires special units; preheating is required; and the entire, closed system must be well designed, maintained and operated if undesirable odor problems are to be controlled. At Pittsburgh the concentration "tanks are to be kept under a slight vacuum, with the air exhausted and discharged to the incinerators for use as combustion air"[7]. It will be most interesting to see how this system of sludge treatment functions after the plant is in operation a while.

Another recent development in sludge digestion—one that attempts to shorten the time of digestion—is that developed under the supervision of Philip F. Morgan of Iowa State University[8] and covered by patent applications filed by Chicago Pump Co. This scheme begins with the idea that sludge digestion is really two processes—first, a biochemical reaction during which the actual digestion takes place; second, a physical and mechanical separation of the digested sludge into the solid and liquid portions. So far this is very similar to the two-stage operation previously described.

Gas Recirculation

In previous attempts to speed up the digestion process itself, the biochemical breakdown of sludge solids by anaerobic bacteria had been investigated in detail by other workers. Morgan and his group had the objectives of making the microorganisms do their utmost under controlled conditions, and to do this throughout the digestion tank. He found that by re-

circulating digester gas through porous diffusers, both objectives were accomplished (Fig. 4).

Not only was digestion occurring faster, but the entire contents of the digester were stirred and rolled around, somewhat like an activated sludge aeration tank. The purpose of this stirring was to mix thoroughly and bring into intimate contact the seed sludge (that which is in active digestion), the raw sludge, and the digester gas.

When the pilot plant digesters were operated in this manner at 95°F the retention time for the digestion process was reduced to 7.2 days. Naturally, after this period of intense digestion the sludge had to be further treated in some manner to separate the digested sludge from the liquid portion mechanically.

According to these studies based upon four years of pilot plant investigation and four months of full-scale operation at the Columbus, Ohio, plant[9], this method of accelerated sludge digestion showed the following:

1. A well-stabilized sludge can be produced in a shorter retention time as indicated by (a) gas production per pound of volatile solids added (7.1 cu ft per pound of volatiles added); (b) reduction of total solids (6.6 per cent in the raw to 4.6 per cent in the digested sludge); (c) reduction of volatiles from 59.75 per cent to 50.2 per cent.

2. Objectionable odors were absent.

3. The sludge produced can be readily dried, even before concentration. In comparison with sludge from the Iowa City plant, which had 50 days of conventional digestion, the pilot plant sludge dried as fast or faster.

4. No scum layer was found at the top of the pilot plant digester.

5. Since digestion time can be reduced by this process, smaller units or increased loadings are possible. It is recommended by Morgan that digesters be designed on the basis of 0.2 lb of volatile solids per day per cubic foot.

As previously mentioned, one of the results of the recirculation-diffusion method of Morgan was the elimination of the scum layer in the digester and its associated problems. Since scum is a common headache for plant operators, the method of Fuhrman* used at the District of Columbia sewage plant[10] and elsewhere, should be of interest.

Basically this method is similar to Morgan's method previously described in that sludge gas is injected into the digester, but differs in not employing a diffuser, nor attempting to separate the two phases of the digestion process. It is simply a method for eliminating the formation of a scum layer.

If this system is used when a digester is started, the formation of a dense scum layer at the surface is prevented. When this system is employed in a going digester having a scum layer, it will break up and disperse the scum and keep it from reforming.

Injection of digester gas can be accomplished in either fixed or floating cover types of tanks. Several points in the installation and operation must be observed. The gas drawn out of the digester for recirculation must be compressed, and because of the explosive nature of sludge gas, the compressor and all electrical controls must be explosion-proof.

Since digester gas is not produced at a rate equal to that of the compressor, operation is intermittent and some means of holding the gas is required. A check system on the line from the gas dome is also needed to prevent the compressor drawing a vacuum on the gas dome of the cover.

When this process is used in a single-stage digester, certain other details must be observed. In a single-stage digester, the bio-chemical digestion of the raw sludge and the subsequent mechanical separation of sludge liquor and the digested sludge occur within one tank. The digestion usually takes place in the midsection of the tank and the separation and settling in the lower portion.

To preserve this arrangement, the compressed gas is injected at several points around the tank below the scum layer, but above the lower solids layer. In most instances this will be at about the mid-depth of the tank in the liquid, actively digesting zone (Fig. 5).

Application of the recirculated gas at this level serves the following purposes:

1. Intimate mixing of the raw sludge, gas, and digesting sludge is secured, leading to greater efficiency of the digestion process.

2. The digested solids below are not disturbed, allowing a more concentrated sludge to be withdrawn.

3. Due to lower hydrostatic pressure at mid-depth compared to bottom-depth, the operating pressure of the compressor is lower and therefore results in more economical operation.

As detailed in the patented process, the compressed gas is discharged through open-end pipes. This means that the bubble size will be relatively large (compared to a diffuser). Large bubbles, it is claimed, are desirable in that they bring the hot (95°F), actively digesting liquor up into the scum layer. Also, large bubbles cause a violent agitation of this layer, tending to break up and disperse it throughout the digestion zone.

*The Pearth system, controlled by patents issued to the Pacific Flush Tank Co.

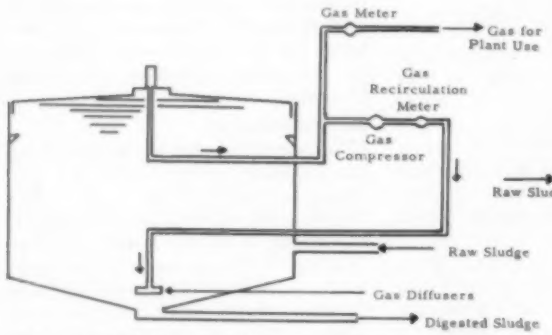


Fig. 4—FLOW diagram for gas recirculation (after Morgan)

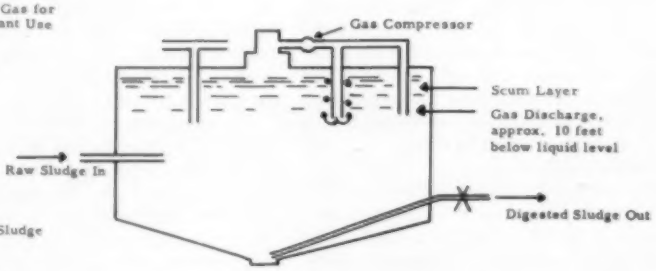


Fig. 5—SCUM control by gas recirculation (after Fuhrman)

One further advantage of this process is claimed: that higher loading rates are possible. This may be attributed to several reasons. First, due to the better contact achieved between the raw sludge and the actively digesting sludge, more efficient digestion takes place. The mechanical stirring and mixing effects of the gas bubbles make this possible. One of the evidences of greater efficiency is the increase in gas production; for example, at the District of Columbia plant circulation increased gas production from 9.5 to 14.0 cu ft per pound of volatile solids added[10].

Another reason for possible higher loading rates is the increased capacity of the digester due to the absence of a scum layer. Again referring to the District of Columbia plant, Fuhrman states: "The combined effect of loss of space to scum and sand (bottom of digester) reduced the effective tank volume by at least one third . . ."[10]. This point should be of special interest to plant operators who are pressed for digester capacity and have a scum layer in the digester.

Pre-Concentration

The next innovation in sludge digestion to be discussed should be especially appealing to operators of activated sludge plants. As these men know only too well, activated sludge contains more moisture than other types of sludge (larger volumes to be removed), and it is harder to remove this moisture. Various attempts in the past have tried to digest activated sludge more efficiently, and these have had various degrees of success. A new process for digesting activated sludge has been worked out on full-plant scale by W. N. Torpey of New York City[11]. This process apparently will allow much higher loading rates while producing a stable, well-digested sludge.

Basically, this process depends upon concentrating the activated sludge by combining it with primary sludge, and allowing the mixture to concentrate in a tank ahead of the digester. The concentrated, combined sludge is then fed to a single-stage digester, held for shorter than conventional times, and the digested sludge is then withdrawn for ultimate disposal. A most interesting feature of this process is that by its use sludge digestion becomes a continuous process instead of the customary fill and draw procedure.

At the Bowery Bay sewage treatment plant in New York City, Torpey worked with the excess sludge from a typical activated process and that from a modified aeration process. Each of these was combined with raw primary sludge in the thickening tanks, which were circular tanks with picket-fence-type sludge thickening and collecting mechanisms.

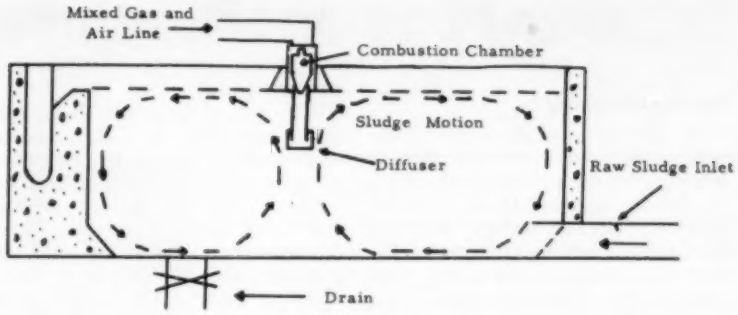


Fig. 6—SUBMERGED combustion sludge heater

The sludge digester used provided 2.1 cu ft per capita as used with conventional digestion, and was provided with internal hot water coils for heating. As plant operation expanded, it was found that the design capacity was adequate if the plant was operated on the modified aeration system, but when operated as an activated sludge process the digesters were inadequate. In an attempt to provide sufficient digestion capacity this new method of sludge concentration was tried.

Primary sludge and that from the modified aeration process were combined and concentrated in the thickening tank. By controlling the volumes of sludge entering the thickener, and the solids retention time, solids concentrations of this combined sludge average 11.2 per cent. This meant that sludge pumpage to the digester was about one-third the former volume.

After a "breaking-in" period, one digester was found capable of handling a raw sludge load that previously required four digesters in two-stage operation. This breaking-in consisted of allowing the bacteria in the original digester to become accustomed to the greater amounts of food (increased concentration of solids).

It was also found desirable to recirculate part of the digester contents from the digested sludge and decant levels and mix this with the raw sludge feed at the raw sludge header. This served to preheat the raw sludge, preventing cold pockets in the digester. It also allowed digestion to begin immediately due to the mixing of the seed material and the raw sludge.

This combining of primary and excess modified aeration sludge in a thickening and digestion process as described resulted in satisfactory operation with a digester capacity of 0.5 cu ft per capita, compared with the 2.0 cu ft per capita previously required. For the digester at the Bowery Bay plant, this meant a displacement period of 31 days.

Gas production from this concentrated digestion process was similar to that from conventional types, both qualitatively and quantitatively. The volume of digested sludge produced was also found to be equal to that previously produced.

When this thickening process was used on primary sludge and excess step aeration sludge, the volume of raw sludge into the digester increased, although it was still less than that without thickening. The displacement period in the digester dropped to 15 days. Nevertheless, "performance of the high-rate digester was equal to systems of eight times the volume, on a per capita basis, with respect to concentration of digested sludge"[12].

Before leaving this discussion, it might be advisable to point out some of the cautions mentioned by Torpey, as follows:

1. All unnecessary water must be kept out of the system; for example, seal water for centrifugal pumps, flushing waters from Venturi meters, etc.
2. Sludge must be fed almost continuously into the digester. This means that facilities must be provided for continuous digested sludge removal.
3. The entire volume of the digester should be utilized for best operation. This means good mixing within the digester.
4. The sludge feed should be mixed with digester liquor prior to entering the digester.
5. There is no release of sludge liquor within the digester. It has been released in the concentration tank.
6. Heat requirements for the digester are lower since smaller volumes of raw sludge enter the digester.
7. The excess sludge liquor released in the concentration tank is lower in

B.O.D. and more amenable to treatment than the usual digester sludge liquor.

Submerged Heating

In a previous section of this article, mention was made of sludge digester heating and the problems relating to the heating system. At the Philadelphia Northeast sewage treatment plant a novel heating arrangement has been in successful operation, with none of the usual difficulties[13]. Although the theory is not new, having been used in other applications, the mechanics of the process had to be adapted to sludge heating.

Essentially the process consists of preheating the cold raw sludge by a submerged heating arrangement before it enters the digester (Fig. 6). At the top of the preheating tank is a burner in which the sludge gas and air are burned. Sludge gas and air are mixed and compressed before being introduced into the burner. Here, on ignition, the gases expand and are forced out through a diffuser directly into the sludge. Due to the velocity of the hot gases passing out of the diffuser, turbulence is created. This results in a sludge rotation and mixing as well as heating. The heated sludge (approximately 110°F) flows over a weir into a collecting sump, from which it is pumped directly into the digesters.

The report from the Philadelphia plant states that these sludge heaters have been operated with few difficulties, have given good digestion temperature, and are easy to clean and maintain. Thermal efficiency is estimated to be about 85 per cent. This type of sludge heating was so successful at Philadelphia's Northeast plant that when the new Southeast plant was planned, submerged sludge heating was included.

Summary

These then, are some of the more recent developments in sewage sludge digestion. Although they are mainly covered by patents, or require special equipment, it is hoped that their basic ideas may lead plant operators to other, new, thoughts on this topic.

As all operators know, a revised (10th) edition of "Standard Methods"[14] has recently been published. A number of procedures have been changed. The next article in this series will discuss those changes that are of interest in routine plant operations.

References

[1] Anon., "Penn State Operations Discussed," Wastes Eng., *25*, 11 (1954).
[2] Calihan, R. H., "Controlled Heating Solves Sludge Handling Problems," Wastes Eng., *25*, 118 (1954).
[3] Parkes, G. A., "Electrolysis at Terminal Island," Sew. Wks. Jour., *13*, 48 (1941).
[4] ———, "Operators' Forum," Sew. Wks. Jour., *21*, 726 (1949).
[5] Laboon, J. F., "Experimental Studies on the Concentration of Raw Sludge," Sew. & Ind. Wastes, *24*, 423 (1952).
[6] Schroepfer, G. J., "Possible Economics in Sludge Disposal Practice," Trans. ASCE, *110*, 194 (1945).
[7] Flood, F. L., "Experimental Studies on the Concentration of Raw Sludge—Discussion," Sew. & Ind. Wastes, *24*, 443 (1952).
[8] Morgan, P. F., "Studies of Accelerated Digestion of Sewage Sludge," Sew. & Ind. Wastes, *26*, 462-476 (1954).
[9] Blodgett, J. H., "Experimental Studies on the Concentration of Raw Sludge—Discussion," Sew. & Ind. Wastes, *26*, 476-478 (1954).
[10] Fuhrman, R. E., "Scum Control in Sludge Digestion," Sew. & Ind. Wastes, *26*, 453-458 (1954).
[11] Torpey, W. N., "High-Rate Digestion of Concentrated Primary and Secondary Sludge," Sew. & Ind. Wastes, *26*, 479-494 (1954).
[12] Ibid., p. 494.
[13] Baxter, S. S., and Horlacher, H. F., "Submerged Sludge Heating at Philadelphia's Northeast Works," Sew. & Ind. Wastes, *26*, 961-966 (1954).
[14] "Standard Methods for the Examination of Water, Sewage and Industrial Wastes." Amer. Pub. Health Assn., New York, N. Y. (1954).

Activated Sludge Froth Control

by JOHN L. WOOTEN
Superintendent
Sewage Treatment Plant
Carbondale, Illinois

THIS article is for the operator who does not understand scientific theory, equations, etc.—the operator who speaks in everyday language and operates his plant accordingly.

We have not or will not make any such statement as that we have definitely cured frothing, but only that we have learned to control it to a degree.

Everyone who operates an activated sludge type treatment plant has come into contact with this problem at one time or another. If conditions were allowed to exist as they would without active control, the sewage plant would resemble just what the average citizen thinks the plant to be.

At the start we asked, we read, and we experimented. Just when we were about to give up in disgust, we came up with something that may be of value to other operators who have the same situation.

We worked from the idea that the froth is caused by detergents. First, we found that there must be ideal conditions for good treatment: over or under treatment can cause frothing also.

To maintain desirable results, make sure the diffusers are clean. In mechanical plants, aeration periods may have to be lengthened or shortened. The aeration units must be kept in balance as nearly as possible (rate of flow per tank, D.O., ppm of solids in the mixed liquor, etc). We maintain a D.O. of 3.5 to 4.5 ppm in aeration units, which gives 1.2 to 1.7 ppm D.O. in the final effluent.

Treatment must be started at 2,000 ppm or less of solids in the mixed liquor. It must be maintained at a constant level until a good treatment point is reached. Then the solids in the mixed liquor are increased until frothing dissipates. At this point great care must be exercised, because the danger point of overloading the aeration is being reached. Then, if any sign of trouble develops, the excess solids are unloaded or wasted until the trouble disappears or the oxygen saturation point is reached. Constant vigilance is necessary to keep this cycle going.

It must be remembered that no two plants work alike. The specific combination to suit the particular plant must be found.

It takes bacteria to treat detergents; it takes ideal conditions to grow and keep them.

What seems to be a sparkling clear effluent has many times been seen to froth at the outfall sewer and for miles downstream wherever there happens to be a fall. It will also be noticed that this condition will clear up almost completely when frothing is cured in the plant proper. This indicates that good treatment is being maintained and that the detergents are breaking down under this condition.

Why a Businessman Became Mayor

by J. P. LAWLOR

Mr. Lawlor, Mayor of Ames, Iowa, is President of General Filter Co. located in that city. He has found the duties of public office to be a tremendous asset in his own business. His experience constitutes a sound recommendation for wider participation by businessmen in their local government.

MANY businessmen, as well as those in our field of municipal and industrial engineering, are today accused of being a cross between the ostrich, which sticks its head in the sand to hide from a situation, and the soap box orator who "cusses" everybody and everything but never does anything constructive about it. It is for this reason that I decided to run for Mayor of our little community of Ames, Iowa, which has a population of about 23,000 people. With the help of my friends and the businessmen of Ames, I was elected and took the oath of office in January 1954.

I decided to run for the mayorship despite the fact that I head an organization which specializes in water treatment for cities and industries, large and small. When you analyze the situation, government is really the biggest business in the world and, if it is to carry on as our nation's founders intended, more of us in the field of engineering and in the business world must shake loose from our complacency of recent years and take a more active part in government—and especially in local government.

Some of my friends have considered me of doubtful sanity: but, I took on the mayorality campaign because there was a need in our town, just as there is in many a town, to have a sound business administration running the local government, regardless of size.

The Need for Business Administration

We hear a great deal about taxes and inflation these days. Inflation has been brought about in this country as a matter of deliberate government policy over a period of many years, with the recent Korean war thrown in for good measure. During the last depression, government economists set up a government-made synthetic form of prosperity (really inflation), based upon a government-supplied excess of purchasing power and a government-created short supply of materials and commodities.

Such a program obviously requires money and lots of it, and the government does not produce wealth—it consumes wealth. The only money the government has is that which it takes from the citizens in the form of taxes, either direct or indirect, and what it borrows, usually from its own citizens. To make goods and services scarce, therefore more expensive, the government paid the farmer not to plant crops and to kill his little pigs; and then pressed for shorter hours and more pay for labor to further increase the cost of production.

The Matter of High Taxes

As a result of these and other factors in recent years, high taxes have brought in tremendous revenues to the government. Government, in turn, sought out ways and means to dole out billions of dollars to millions of people.

Just sit down with your auditor sometime and figure out what you pay in taxes of all kinds—taxes that follow you from your birth to your grave and even after. This is only *one* reason why we should all be interested in more efficient, and more economical government.

Another reason why I ran for Mayor was because of my wife and children. They are all grown up now, my three boys. One of them is teaching, one of them is just completing his service to his country in the Korean Theatre, and the third is a sophomore at our Iowa State College.

Like myself, they are all interested in trying to be good businessmen. When our family was discussing the matter of running for Mayor, we talked it over at the family table, and they all decided that it would be a good thing for the city and for our family as well as for myself.

Good Government at the Local Level

I'm convinced that good government starts at the local level. When you neglect your government at the local level, the politicians extend their machines; and, given time, the machine grows into national control with an unbeatable combination. These local machines in our small towns train the men who tomorrow become our state and national leaders. That is why local officials must be men of business, men of the community and men who can spare some time to get into the biggest business in the world—our government.

It's a great experience and one which I know will pay off, not only for today, but for the future. That's why I repeat—don't waste your time cussin' the government. Do something about it. And remember if we continue to "let George do it," it won't be long before a guy by the name of Kruschev may be doing it for us.

You may ask—"How will the duties of public office affect my own business?" In reply I can say—"I believe it can be a tremendous asset." Despite the fact that a great deal of my time is given to our local municipal matters, I find that our company continues to operate in the same efficient manner. By being Mayor, I feel that this public service has lifted our company to a new high in the respect enjoyed from our customers, our friends, and our competitors. It will do the same for any other businessman.

W&SW

"Mr. Pluvius, no trouble getting a patent on your rain-making machine; but, first you'll have to prove to me that it works."

THE EDITOR'S COMMENTS

The MF Technique Deserves Full Standard Status

The membrane filter technique for the bacterial examination of water, sewage and wastes was introduced about 10 years ago. It was this writer's belief (at least hope) that this time and labor-saving method would prove to be the "answer to the maiden's prayer"—a quick, direct method of bacteriological analysis. So far, this has not proven to be the case, as evidenced by the fact that after ten years of application and refinement in the water and sewage field the membrane filter technique has only been accorded a "tentative" status as an officially accredited standard method in the recently revised "Standard Methods for the Examination of Water, Sewage and Wastes"—10th Edition (1955).

If we can judge from recently published articles and reports dealing with the membrane filter (MF) technique, it would seem that the sub-committee charged with the revision and improvement of the bacteriological sections of "Standard Methods" were overly cautious in not giving the MF technique at least equal rating with the less precise, cumbersome and slow Most Probable Numbers (MPN) method of determining bacterial content of waters, sewages and wastes.

In this issue, not far removed from this page, appears an article by A M Rawn and F. R. Bowerman of the Los Angeles County Sanitation Districts of California. Captioned—"The Membrane Filter: Advantages and Disadvantages."

After reading the Rawn-Bowerman report it was our opinion that the amplifying heading of the article should have read "Advantages" in capitals and "Disadvantages" in lower case. We say this because the reported advantages of the MF technique appear to us to outweigh the disadvantages ten to one, if not more.

In our November 1955 issue Professor Rolf Eliassen of the Mass. Institute of Technology effectively champions the MF methods in his article—"Membrane Filters for Water Quality Control: A Realistic Appraisal." The fact that the Rawn-Bowerman article (unsolicited) so thoroughly supported the arguments advanced by Prof. Eliassen, and others to whom he gives credit, led us to disrupt our January issue make-up in order to publish the Rawn-Bowerman report with a minimum of delay.

Those who have not read the Eliassen evaluation of the MF technique should do so. The arguments for the method over the MPN technique of standard methods are clear cut, strong, and well supported by study, evaluation and in several reports cited. He directs attention to the element of time in completing tests with the two methods. The MF test is conclusive after the 18th hour whereas the cook-bookish MPN test requires from two to three days. He points to the labor-saving advantages, as well as the exactness and precision of the MF method in an illustrated comparison with the MPN method. Of all the attributes of the more scientific MF method *precision* and quick results stand out in the Eliassen engineering mind as the major advantages in water quality control.

In summing up, Eliassen pleads for "the adoption of the MF technique as an officially accredited standard procedure," because of its unquestionable superiority over any other practical method of measuring the bacterial quality of potable waters on a *precise* basis.

In their evaluation of the precision of the MF technique over the MPN method, Rawn and Bowerman present examples to show instances wherein the MPN method of determining coliform density could readily be in error by 45 per cent (low) in comparison to 100 per cent accuracy with the MF method, even though only a 50 ml sample portion be used in the MF test. Thus is countered the argument that large 200 ml sample portions must be used in the MF methods.

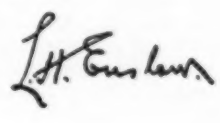
In studying pollution currents from an ocean outfall in tidal waters field-testing is employed as far as practicable by the Los Angeles County Sanitation Districts. In this the MF method has an especial appeal over the more cumbersome MPN procedure. Evidence points to the selectivity of the membrane filter toward *E. coli* in sewage-sea water mixtures and to Rawn and Bowerman this is a point in favor of the MF method for determining extent of sewage pollution.

Perhaps the greatest appeal of the MF technique to the Los Angeles County Districts is the matter of overall economy resulting from the use of the MF method—thus refuting argument of higher costs as a deterrent to adoption of the MF method.

In summing up, Rawn and Bowerman put their high regard for the MF method in a nut-shell when stating—"It can be said that the simplicity, ease, convenience, *speed and precision* with which the MF test is completed, and the *meaningful* bacteriological levels obtained, have been clearly demonstrated in the field and the laboratory through almost 4 years of routine testing, involving more than 8000 tests."

From such unimpeachables as Eliassen, Rawn, Bowerman, their arguments for the tentatively standard MF method over the officially standard MPN method are indeed arguments that might well have changed the decision of the committee responsible for having let into "Standard Methods" the Membrane Filter Method in a "tentative" status only, until the next revision of "Standard Methods" in 1960. Another 12 months before "closing of the books" in revising "Standard Methods" might well have changed the views of those conservatives responsible for denying the MF method the full standard rating in the 1955 edition.

Like Eliassen, Rawn, Bowerman, Thomas of M.I.T. (and others named in their reports) we believe that the MF method deserves a full rating as a standard method, at least on equal footing with the far more cumbersome, time consuming and less precise MPN method. By all indications, experience and perfection will without doubt in time result in the MF technique becoming ultimately *the* standard method, completely displacing the less precise cook-bookish MPN method.



Eight 110-ft. diameter Chicago-Wiggins Lodek Covers at the City of Philadelphia Southwest Disposal Plant.

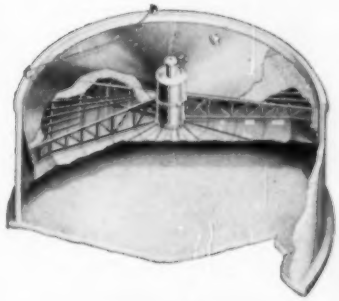
ASK LEADING ENGINEERS ABOUT....

Chicago-Wiggins*

DIGESTER COVERS and GAS HOLDERS

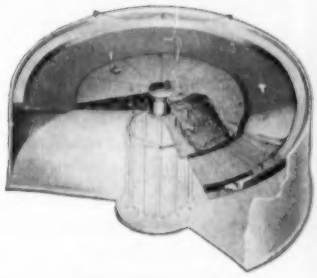
Ask leading engineers why, in the past four years, they have specified Chicago-Wiggins Digester Covers and Gas Holders for more than 50 major installations. They'll tell you about the maximum gas pressures that are possible, the positive scum submergence and the non-tipping feature of Chicago-Wiggins Covers. They're sure to mention superior structural design which provides the highest live load safety factor of any cover. They will explain how lower ceiling plate stresses are achieved through modern welding and design; how a positive anti-rotation device keeps trusses always above tank corbels.

The features that have earned this preference by consulting and design engineers are yours when you specify Chicago-Wiggins Digester Covers and Gas Holders. Write Dept. H for complete details.



PONTOON COVERS

Always float on liquid—never on gas.



LODEK COVERS

Lowest first cost for 75-ft. to 150-ft. diameters.

WET GAS HOLDERS

Self balancing with a positive seal. Economical in first cost and in maintenance.

CHICAGO PUMP COMPANY

Subsidiary of Food Machinery and Chemical Corporation

SEWAGE EQUIPMENT DIVISION

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

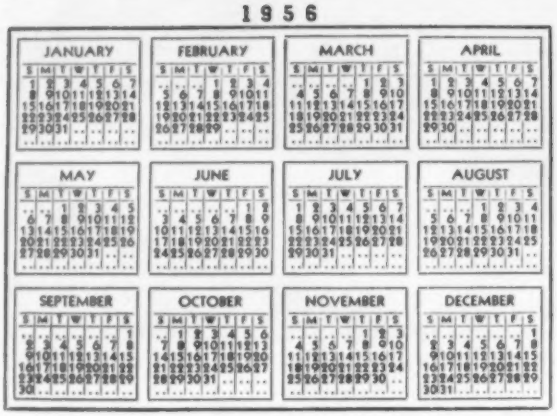
Flush Kleen ®, Screw-Feller ®, Plunger, Horizontal and Vertical Non-Clogs Water Pumping Units, Samplers . . . Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Barminutor ®, Comminutors.

Chicago-Wiggins Digester Covers and Gas Holders are products designed specifically for sewage digesters. They are the result of the combined experience of Chicago Sewage Engineers and Mr. John H. Wiggins, designer of the well-known Wiggins Floating Cover, of which more than 5000 have been built in the last 25 years.

W & SW

Meetings Scheduled

1956



Jan. 17—New York, N. Y. *(Park Sheraton Hotel)*
NEW YORK SECTION, A.W.W.A. Mid-winter Luncheon; Secy., Kimball Blanchard, Rensselaer Valve Co., 56 Grand St., White Plains, N. Y.

Jan. 19-20—New York, N. Y. *(Belmont-Plaza)*
NEW YORK SEWAGE AND INDUSTRIAL WASTES ASSOCIATION (Annual Meeting) Lexington at 49th Street, Exec. Secy., R. C. Sweeney, State Department of Health, 21 North Broadway, White Plains, N. Y.

Jan. 26-27—Berkeley, California *(University of California)*
CONFERENCE ON WATER RECLAMATION—Harold B. Gotaas, Director, San. Eng. Research Laboratory, Univ. of Calif., Berkeley 4, Calif.

Feb. 8-10—Indianapolis, Indiana *(Lincoln Hotel)*
INDIANA SECTION, A.W.W.A., Secy., Robert J. Becker, Indianapolis Water Company, 113 Monument Circle, Indianapolis 6, Ind.

Feb. 13-17—Dallas, Texas
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Exec. Secy., W. H. Wisely, 33 W. 39th St., New York 18, N. Y.

Feb. 14—Newark, N. J. *(Essex House)*
NEW JERSEY SECTION, A.W.W.A., C. B. Tygert, Secy., Box 178, Newark 1, N. J.

Feb. 26-29—Los Angeles, Calif. *(Statler Hotel)*
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.
F. J. Van Antwerpen, 25 W. 45th St., New York 36, N. Y.

Feb. 26-29—Fort Worth, Tex. *(Texas Hotel)*
TEXAS PUBLIC HEALTH ASSOC., V. M. Ehlers, Secy., Dept. of Health, 2202 Indian Trail, Austin, Tex.

Mar. 4-9—College Station, Tex.
TEXAS SEWAGE & WATER WORKS ASSOC. (Annual Short School) Texas A & M College, V. M. Ehlers, Secy., State of Tex., Dept. of Health, 2202 Indian Trail, Austin, Tex.

Mar. 14-16—Atlantic City, N. J. *(Traymore Hotel)*
NEW JERSEY SEW. & IND. WASTES ASSOC., Michael S. Kachorsky, Sec.-Treas., P. O. Box 766, Manville, N. J.

Mar. 18-21—Augusta, Georgia *(Bon Air Hotel)*
SOUTHEASTERN SECTION, A.W.W.A., Secy., N. M. deJarnette, Engr., State Dept. Pub. Health, 245 State Office Bldg., Atlanta 3, Ga.

Mar. 18-19—Little Rock, Ark. *(Marion Hotel)*
ARK. WATER & SEWAGE CONF., Harrison Hale, Sec.-Treas., Southern State College, Magnolia, Ark.

Mar. 21-23—Chicago, Illinois *(LaSalle Hotel)*
ILLINOIS SECTION, A.W.W.A., Secy., Dewey W. Johnson, Cast Iron Pipe Research Association, 122 So. Michigan Ave., Chicago 3, Ill.

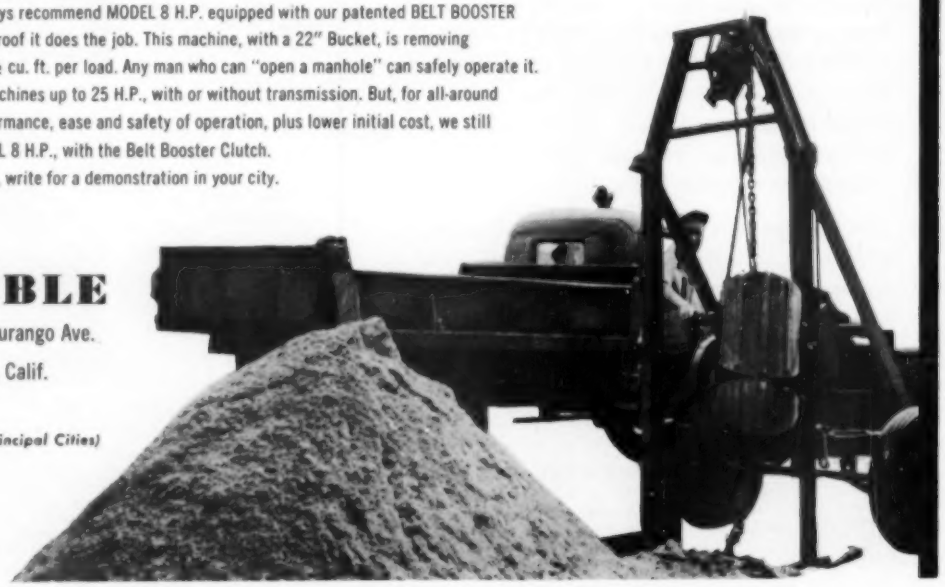
Apr. 3-5—Philadelphia, Pa. *(Bellevue-Stratford Hotel)*
PENNSYLVANIA SECTION, A.W.W.A., Secy., L. S. Morgan, State Dept. of Health, Greensburg, Pa.

JUST 8 H.P. cleaned this 24″ line!

Many cities specify 13 or 25 horsepower bucket machines, and some request transmission models, to work 24″ lines.
However, we always recommend MODEL 8 H.P. equipped with our patented BELT BOOSTER CLUTCH. Here's proof it does the job. This machine, with a 22″ Bucket, is removing approximately 2½ cu. ft. per load. Any man who can "open a manhole" can safely operate it. We can supply machines up to 25 H.P., with or without transmission. But, for all-around trouble free performance, ease and safety of operation, plus lower initial cost, we still recommend MODEL 8 H.P., with the Belt Booster Clutch.
To get more facts, write for a demonstration in your city.

FLEXIBLE
INC. 3786 Durango Ave.
Los Angeles 34, Calif.

(Distributors in Principal Cities)



Canton Gets a New Concrete Distribution Line

This crew is putting in the fourth piece of pipe in a 4500-foot concrete feeder line for Canton, Ohio. The line runs from the north corporation line south on Broad, west on 8th, and south on Wertz to 3rd where it ties into an existing 12-inch line. Along the route the new line feeds distribution lines of 6, 8 and 12 inches.

The line went in easily and with little interference to traffic. The backhoe in the picture dug the trench and laid the pipe for the entire line. A supply of short lengths and bevel adapters was kept on the job to make on-the-spot turns to clear obstructions. A bevel adapter is a small special made up of a bell ring and spigot ring set back to back at an angle of 2° to 4°.

The line has been tapped three times since it was laid in 1954. The ¾" taps were made by Canton Waterworks crews using their regular equipment and new-design fixtures furnished by the manufacturer of the pipe. The entire line is 24-inch prestressed concrete cylinder pipe made by Price Brothers Company, Dayton 1, Ohio. Price has plants in Dayton, Cleveland and Miami, Fla.

Price

down by the seashore

TATEM Surf Club

Carefree living enhanced by . . . large, cheerful guest rooms . . . private pool, ocean beach, cabana club . . . dining room and cocktail lounge.

Rates from $8 double, European Plan.

SELECTED CLIENTELE

Write for Booklet

On the Ocean at 43rd Street MIAMI BEACH

Apr. 4-6—Topeka, Kansas *(Jayhawk Hotel)*
KANSAS SECTION, A.W.W.A., Secy., Harry W. Badley, 119 W. Cloud, Salina, Kansas.

Apr. 5-6—Chapel Hill, N. C. *(Carolina Inn)*
FIFTH SOUTHERN MUNICIPAL & IND. WASTE CONF., Daniel A. Okun, Univ. of North Carolina, Chapel Hill, N. C.

Apr. 5-7—Safford, Ariz. *(Buena Vista Hotel)*
ARIZONA SECTION, A.W.W.A., Secy., Quentin M. Mees, Ariz. Sewage & Water Works Assn., 721 N. Olson Ave., Tucson, Ariz.

Apr. 5-7—Safford, Arizona *(Buena Vista Hotel)*
ARIZONA SEWAGE & WATER WORKS ASSN., Quentin Mees, Sec.-Treas., 721 N. Olsen Ave., Tucson, Ariz.

Apr. 6-7—Livingston, Montana *(Murray Hotel)*
MONTANA SECTION, A.W.W.A., Secy., A. W. Clarkson, State Board of Health, Helena, Montana.

Apr. 11-13—Lincoln, Nebraska *(Cornhusker Hotel)*
NEBRASKA SECTION, A.W.W.A., Secy., John E. Olsson, 922 Trust Bldg., Lincoln, Nebr.

Apr. 18-20—Utica, New York *(Hotel Utica)*
NEW YORK SECTION, A.W.W.A., Secy., Kimball Blanchard, 56 Grand St., White Plains, N. Y.

Apr. 19-20—Natural Bridge, Va. *(Natural Bridge Hotel)*
VIRGINIA IND. WASTES AND SEW. WORKS ASSN., J. L. Hamrick, Sec.-Treas., 415 W. Franklin St., Richmond 20, Va.

Apr. 23-25—London, Ontario *(Hotel London)*
CANADIAN SECTION, A.W.W.A., Secy., A. E. Berry, 72 Grenville St., Toronto, Ont., Canada.

Apr. 25-28—Santa Rosa, Calif. *(Hotel not selected)*
CALIF. SEW. & IND. WASTES ASSN., J. C. Mallery, Sec.-Treas., 4822 N. Dunsmore Ave., LaCrescenta, Calif.

Apr. 26-28—Victoria, B. C. *(Canada Empress Hotel)*
PACIFIC NORTHWEST SECTION, A.W.W.A., Secy., Fred D. Jones, Distr. Supervisor, Rm. 305, City Hall, Spokane, Wash.

May 6-11—St. Louis, Mo. *(Diamond Jubilee Conference)*
A.W.W.A. CONVENTION, Secy., Harry E. Jordan, A.W.W.A. Assn., 521 Fifth Ave., New York 17, N. Y.

HAPMAN
Grit Conveyors

- Rugged Construction
- Low Power Requirements
- Neoprene Flights
- Adaptable to many needs

Write for further information

STUART
CORPORATION
516 N. Charles St., Baltimore 1, Md.

switch to

Anthrafilt
Trade Mark Reg. U.S. Pat Off.

THE MODERN ALL-PURPOSE
FILTERING MEDIUM

Best for All Types of Filters

ANTHRAFILT
offers important advantages over sand and quartz

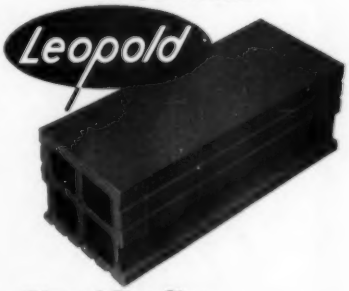
DOUBLES length of filter runs.
REQUIRES only half as much wash water.
KEEPS filters in service over longer periods.
INCREASES filter output with better quality effluent.
GIVES better support to synthetic resins.
PROVIDES better removal of fibrous materials, bacteria, micro-organic matter, taste, odor, etc.
IDEAL for industrial acid and alkaline solutions.
EFFECTIVE filtration from entire bed.
LESS coating, caking or balling with mud, lime, iron or manganese.

Write for further information, test samples and quotations to:

PALMER FILTER EQUIPMENT CO.
P. O. Box 1696—822 E. 8th St., Erie, Pa.

Representing
ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Bldg.,
Wilkes-Barre, Pa.

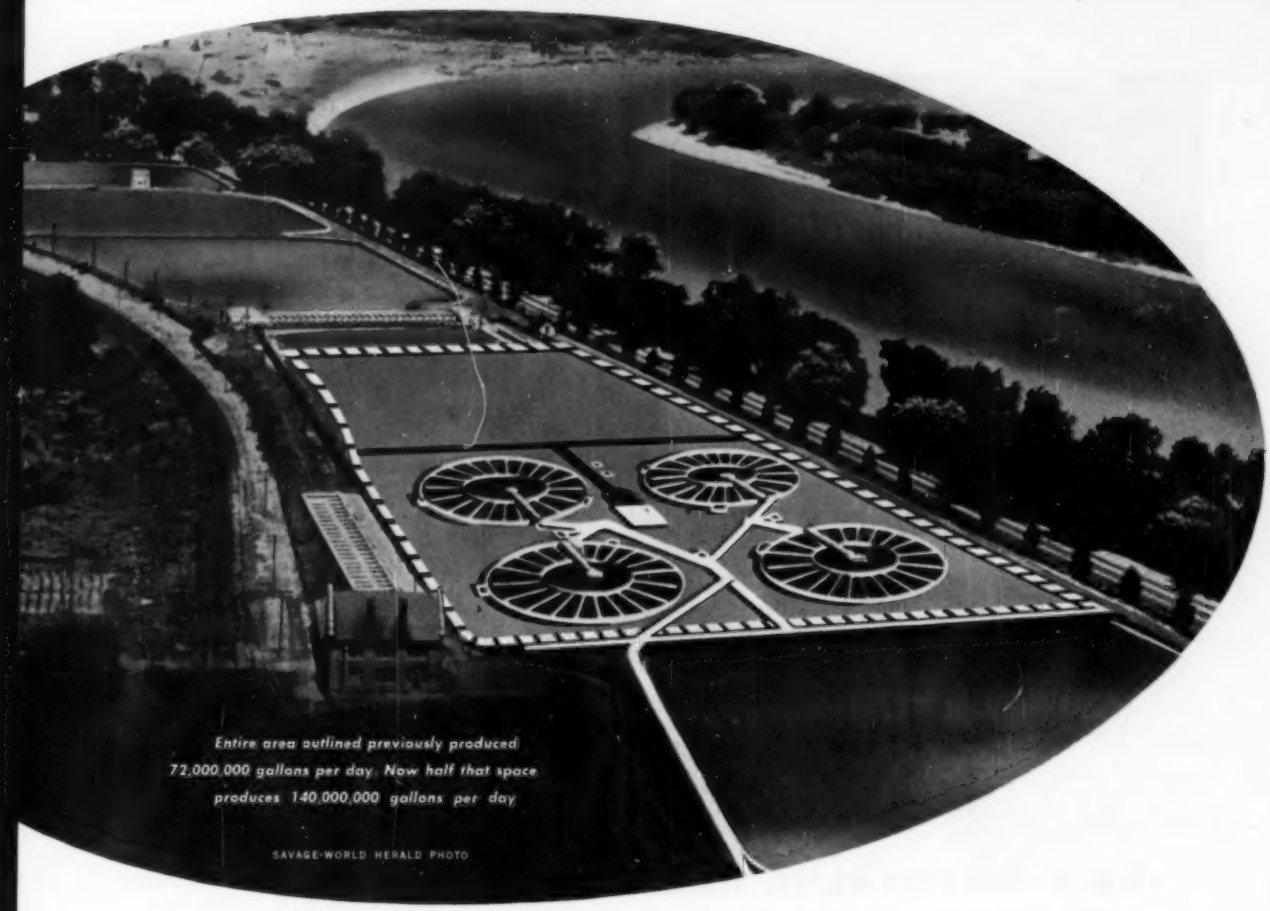
PROVED PERFORMANCE
in over 300 plants with a daily capacity of 1¾ billion gallons...



Glazed Fire Clay
TILE FILTER BOTTOMS

Leopold Duplex Filter Bottoms are getting more popular every day. And for good reasons, too. They last longer, perform better, and are unequalled in economy. Want more details on this "performance-proved" filter bottom? Write us today. No obligation.

F. B. LEOPOLD CO., INC.
2413 W. Carson Street, Pittsburgh 4, Pa.



Entire area outlined previously produced 72,000,000 gallons per day. Now half that space produces 140,000,000 gallons per day.

SAVAGE-WORLD HERALD PHOTO

OMAHA CHOOSES INFILCO EQUIPMENT

for

WORLD'S LARGEST

high-rate water treating plant

...saves hundreds of thousands...doubles production in half the space with latest ACCELATOR® clarifying units.

Consulting Engineers:

BURNS & McDONNELL ENGINEERING CO.

Kansas City, Mo.

Now another important city has turned to INFILCO high-rate water-treating equipment because of the advantages it provides. The plant will be the largest of its kind in the world, with a capacity of 140,000,000 gallons per day.

The Metropolitan Utilities District of Omaha needed to greatly increase production of high quality water from the Missouri River, in limited space at minimum cost. Extensive studies proved that "ACCELATOR" clarifiers were the best answer.

Over 1900 "ACCELATOR" treating plants are now producing results like these—results you, too, can expect from INFILCO's advanced engineering and equipment.

INFILCO KNOWS HOW! Write for copy of Bulletin No. 1825-3

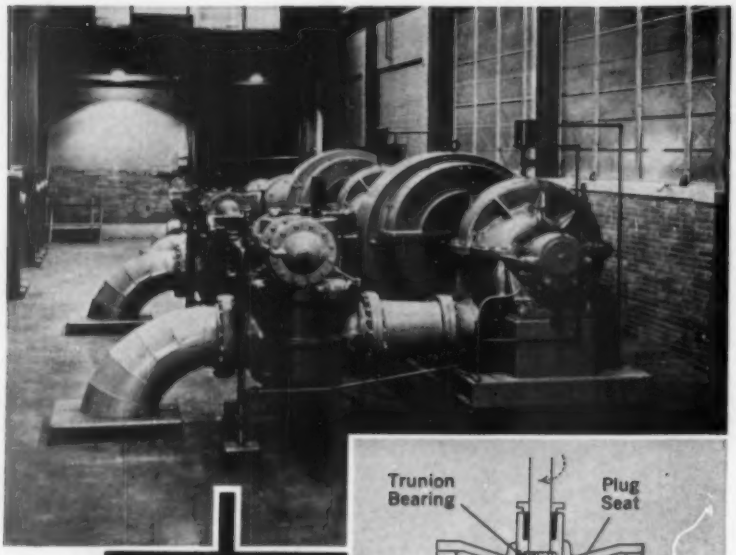
Inquiries also invited on coagulation, precipitation, sedimentation, filtration, flotation, aeration, ion exchange and biological processes.

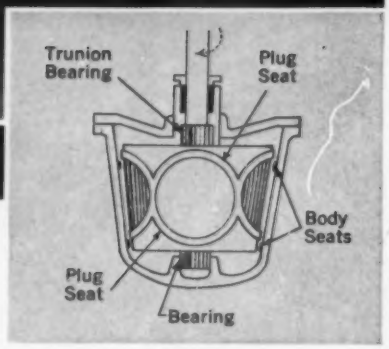
INFILCO INC.
Tucson, Arizona

The ONE company offering equipment for ALL types of water and waste treatment.

INFILCO

FIELD OFFICES IN PRINCIPAL CITIES IN NORTH AMERICA 5942





SMS-ROTOVALVE DESIGN ASSURES POSITIVE CLOSING, LONG LIFE

For fast, easy operation and positive closing, specify SMS-Rotovalves. As shown above, the conical plug, with full line opening, first lifts, then turns, finally reseats. Bronze trunnions eliminate friction and wear to seats, the causes of failure and breakage. Self-purging monel to monel seating assures drop-tight closure.

Rotovalves are designed to solve your control problems. You can be sure of easy operation, precise aperture control, controlled closing time, positive closure, easy mechanical cleaning, low maintenance and long service life. The Rotovalve's full line opening means less head loss and lower pumping costs.

Performance characteristics like these are the result of more than 75 years of hydraulic research and engineering. To get full information on the complete line of Rotovalves, Ball Valves and Butterfly Valves, contact our local representative or write S. Morgan Smith Co., York, Pa.

HYDRAULIC TURBINES · GATES & HOISTS · TRASH RAKES · PUMPS · ACCESSORIES
HYDRODYNAMICS
ROTOVALVES · FREE-DISCHARGE VALVES · BALL VALVES · CONTROLLABLE-PITCH SHIP PROPELLERS · BUTTERFLY VALVES

S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED • TORONTO

SPILLWAY

Haskins, Riddle & Sharp Expand Engineering Staff

Haskins, Riddle & Sharp, Consultinging Engineers of Kansas City, Missouri, have announced an expansion of their technical staff. In the past two years the following eight engineers have been employed, five of whom joined the staff recently.

G. Russell Huff, B.S. in Civil Engineering, Washington State, a former Assistant City Engineer of Kansas City, Missouri, had also served as sanitary engineer with the U. S. Public Health Service.

L. E. Ordelheide, B.S. in Civil Engineering, University of Missouri, until recently was Executive Director of the Metropolitan St. Louis Sewer District. Previously he was Director, Bureau of Public Health Engineering, Division of Health of Missouri.

Charles P. Brooks, B.S. in Agricultural Engineering, University of Missouri, was formerly with the U. S. Soil Conservation Service.

Marlowe Lankford, who served as City Engineer for Hannibal, Missouri, Ulysses, Kansas, and Springfield, Missouri, is a graduate of Hannibal-LaGrange College.

Howard Houska, formerly with a St. Louis engineering firm, received a B.S. in Civil Engineering from the Missouri School of Mines.

Edward C. Maran, B.S. in Civil Engineering, University of Missouri, was previously employed by the St. Joseph Lead Company.

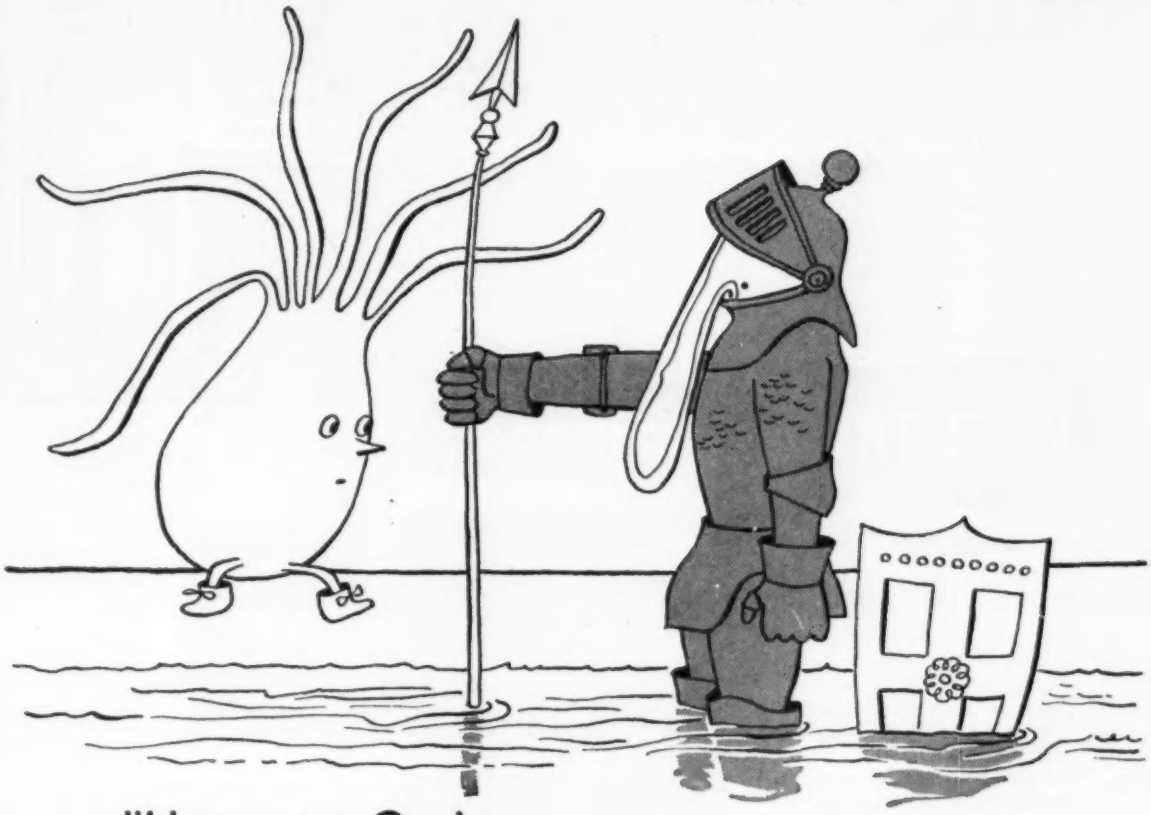
Both L. S. Walker, Jr., B.S. in Architectual Engineering, University of Kansas, and John A. Zaffle, B.S. in Civil Engineering, Iowa State College, have had considerable experience in other engineering firms.

Haskins, Riddle & Sharp specializes in all phases of hydraulic engineering, water supply and sewage collection and treatment.

Ten Years Of Fluoridation At Newburgh, N. Y.

The latest yearly report on controlled water fluoridation studies at Newburgh, N. Y., during the past 10 years reveals the fact that in the 10th year fluoride treatment of the water supply is seemingly responsible for a 60% reduction in tooth decay among

(Continued on page 88A)



"It's no use Orgie— there's no protection against PITTCHLOR®"

That's right, Orgie. Discretion is the better part of valor. Chlorine-susceptible bacteria and algae don't have a chance against the germ-killing powers of Pittchlor.

Pittchlor, the high-test calcium hypochlorite containing a minimum of 70% available chlorine, kills microorganisms on contact. That's why Pittchlor works so fast and effectively in chlorinating water supplies, treating sewage, or wherever else the germicidal and deodorizing action of chlorine is needed.

Pittchlor is dry, white and free-flowing. Its granular form permits ease of application either manually or by mechanical feeders. Write for free folder on the use in which you are interested.

FOR
WATER PURIFICATION
SEWAGE TREATMENT
SWIMMING POOL
SANITATION

Stocked by leading jobbers in 5 lb. resealable cans (9 per case), 3¾ lb. cans (12 per case) and 100 lb. and 130 lb. drums.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER, PITTSBURGH 22, PENNSYLVANIA

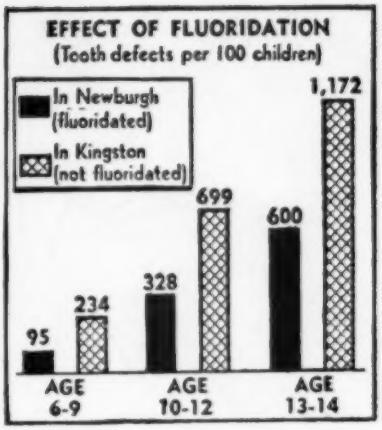
DISTRICT OFFICES: Cincinnati • Charlotte • Chicago
Cleveland • Boston • New York • St. Louis • Minneapolis
New Orleans • Philadelphia • Houston • Pittsburgh
Dallas • San Francisco
IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

children of 10 years and younger. This is the age group that has had fluoride treated water during their entire life.

Amongst children of 10 to 12 years who had not had fluoridated water during the first year or two of life a reduction of 53% was noted. Among the older children of 13 to 14 years who had not had fluoride treated water during the first 3 to 4 years of life the assumed benefits from fluoridated water are less impressive, the reduction being slightly less than 49%. This however, may be taken as the basis of an argument for water fluoridation.

After 10 years of comparison of observations of tooth decay amongst children of Newburgh, N. Y., and Kingston, N. Y., just across the Hudson River where water fluoridation is not practiced, the accompanying chart tells the story in the 10th year of fluoridation better than can words.

The ten-year report of the N. Y. State Dept. of Health makes note of the fact that during the ten continuous years of water fluoridation at Newburgh no differences of medical significance have been disclosed between the children of Newburgh and those of Kingston.



PRELOAD experience

made yours in tank construction

PRELOAD, after years of experience in doing its own construction work, now expands its activities by granting local licenses to experienced and qualified local contractors, most of whom employ former Preload superintendents.

Preload prestressed concrete digesters at Philadelphia Northeast Sewage Disposal Plant.

You profit in these essentials

Preload prestressed concrete tank construction gives engineers and technical officials in charge of sewage disposal the benefits of

- 20 years experience in building over 1,000 tanks, with over 1 billion gallons of water storage capacity.
- Maintenance-free structures.
- Aesthetic possibilities unmatchable for architectural treatment.
- Experience all the way, from design to local contractors for performance.

Technical data and literature on Preload design and construction, available on request.

PRELOAD
TRADE MARK

The Preload Company, Inc.
211 EAST 37th STREET
NEW YORK 16, N. Y.

"Milorganite" A Name Worth Defending

Milwaukee Sewerage Comm. taking legal action to protect now valuable registered name

A settlement of the trademark litigation between the Sewerage Commission of the City of Milwaukee, producers and marketers of better than 70,000 tons of "Milorganite" annually, and Summers Fertilizer Co., et al., distributors of "Pittorganite," has been resolved in favor of the City of Milwaukee in the United States District Court for the Western District of Pennsylvania.

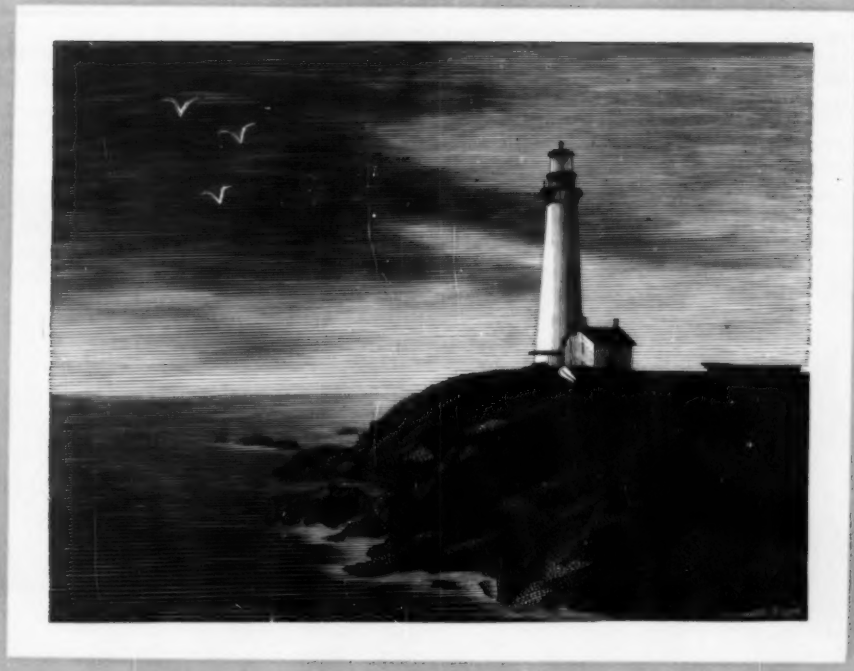
As a result of a decree entered in the above court, Summers Fertilizer Co., Kelly Agricultural Products Co., Philip P. Rosette, and Marcellus Hoover and Versharens, a large fertilizer retailer in the Pittsburgh area, have been perpetually enjoined from selling or marketing a fertilizer product under the name "Pittorganite" or "Kapoganic—formerly called Pittorganite."

The decision was rendered on the grounds that the name "Pittorganite" applied to a fertilizer constitutes an infringement on the tradename "Milorganite." Summers Fertilizer Co. has consented to payment of substantial damages to the Milwaukee Sewerage Commission as the originator of the tradename "Milorganite" as descriptive of a processed organic fertilizer.

This is the first instance in which the Milwaukee Sewerage Commission has had to resort to court action to prevent the use of a trademark containing the derived term "organite."

(Continued on page 90A)

FAMOUS LIGHTHOUSES OF AMERICA



Pigeon Point Lighthouse is located on the Coastal Highway 5 miles south of Pescadero, California. Constructed in 1872, its 115-foot white masonry tower stands on a rocky headland that for many years has been a landmark for ships approaching the Golden Gate from the south. Pigeon Point and the lighthouse are named for the ship Carrier Pigeon, one of the many that came to grief on the outlying rocks in the years before the beacon was built.

Safe Guides to quality in electrochemicals are Niagara Alkali Company's skill and experience in production and its modern facilities for quality control. Put your trust in Nialk® Liquid Chlorine, Nialk Caustic Potash, Nialk Carbonate of Potash, Nialk Paradichlorobenzene, Nialk Caustic Soda, Nialk TRICHLORethylene, Niagathal® (Tetrachloro Phthalic Anhydride).

NIAGARA ALKALI COMPANY

60 East 42nd Street

New York 17, N.Y.

In the past other firms voluntarily discontinued use of a tradename containing the term "organite," or one resembling it, when informed that the coined (trademarked) name "Milorganite" is the exclusive property of the Milwaukee Sewerage Commission.

Natt New Director Of Westchester Water Agency

The appointment of George J. Natt to succeed Simon P. Carman as Director of the Westchester County, N. Y., Water Agency, has been announced by James C. Harding, its Chairman. The appointment became effective January 1, 1956.

Mr. Carman resigned from the Westchester agency to return to Binghampton, N. Y., and re-establish his private consulting engineering practice which he temporarily left to assume the directorship of the relatively new Westchester Water Agency.

Mr. Natt, former Senior Engineer with the New York State Water Power and Control Commission, had served that agency for the past eight years. Before that he was an hydraulic engineer with the New York State Public Service Commission, and prior thereto was for a number of years with the American Water Works and Electric Co. on various types of projects in many parts of the United States.

Assistantships Available at University of North Carolina

Announcement has been made by the Department of Sanitary Engineering, School of Public Health, University of North Carolina, that graduate assistantships are available in Sanitary Engineering and Sanitary Science. Appointees, depending on their qualifications, may be candidates for the degrees of Master of Public Health, Master of Science in Public Health, or Master of Science in Sanitary Engineering.

Assistantships are available beginning in February, June, and September, 1956. Further information may be obtained by writing to the Department of Sanitary Engineering, School of Public Health, University of North Carolina, Chapel Hill, N. C.

Unusual Use Of "Calgon" In Sewage Treatment

A rather unusual use of "Calgon," the widely used compound in corrosion control, has been reported by Glen A. Rogers, operator of the Grandview, Washington, sewage treatment plant.

Shortly after receiving a report of Mr. Rogers' experiences with "Calgon" we heard of a similar experience in the east.

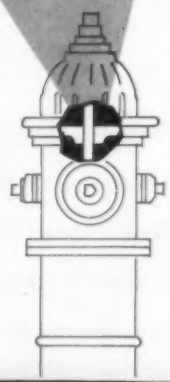
The problem at Grandview was a 12-ft thick scum blanket in the digester. Several schemes to break it up or liquefy the mass had been tried with but meager results. Then, reports Mr. Rogers, he decided to try adding "Calgon." Why he decided is not reported, but he dissolved 10 pounds of the hexametaphosphate in 1,000 gallons of water and pumped it into the scum blanket under high pressure. He let the digester stand overnight. The next day he was able to remove much of the scum layer with the sludge pump.

With this encouragement, Mr. Rogers repeated the treatment until four successive treatments and scum pumpings had been given the digester, after which he was able to completely empty the digester with the sludge pump. A total of 40 pounds of "Calgon" was used in the four treatments.

ED. NOTE: If others have had similar experiences in liquefying scum blankets in digesters we would appreciate hearing about it.

M & H Hydrants can be furnished with Rubber O-Rings Seals if desired. The Seal Plate and O-Rings replace the conventional design of stuffing box, gland and packing. O-Ring Seal Plates can also be supplied for hydrants in service.

The Seal Plate contains two rubber O-Rings. These O-Rings Seals are tight and leakproof and require little or no maintenance. Both O-Rings are made of a special compounded rubber plastic which does not deteriorate. Replacement of the O-Rings is a simple and easy operation, however, if it should become necessary. For complete information, write or wire **M & H VALVE and FITTINGS COMPANY, Anniston, Alabama.**



M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

THIS COUPON BRINGS YOU FREE ENGINEERING RECOMMENDATIONS FOR SOLVING YOUR pH PROBLEM

Beckman engineers will promptly reply to your questionnaire with a detailed analysis of how the quality of your water or process may be improved. No cost or obligation on your part. The Beckman Application Engineering Dept. is at your disposal. Fill in the coupon and mail today.

Beckman Division

BECKMAN INSTRUMENTS, INC.

Fullerton 1, California

☐ Please mail me a pH System Analysis Form that will aid me in receiving a written engineering report for solving the pH problem in our plant.

☐ Please mail me more information on pH applications and add my name to your list to receive additional pH information as it becomes available.

Name _____ Title _____

Firm _____

Street _____ City _____ State _____

S-88

Beckman pH Control ends "red water days" in Macon

Water mains at the Macon Water Works, Macon, Georgia, became so oxidized that iron oxide particles contaminated the water supply, turning it a rusty red color. 100,000 gallons a day was blown off manually through fire hydrants to attempt to clarify the system but the loss of water (particularly during the summer months), the cost of treating water chemically, and "grab sampling" was exorbitant.

Beckman automatic pH equipment was installed to combat the problem. The addition of liquid alum is now automatically controlled by maintaining water pH at 6.5 (±0.1 pH unit) through the flocculation facilities. After foreign matter is settled out, the pH is raised to 8.5 by continuously monitoring in dry lime. At this point, corrosion is inhibited and water is clear, colorless and decidedly better quality even at high rates of flow. Alum and chlorine consumption has been cut in half. "Red water" complaints from users have vanished.

Beckman pH equipment is sold through Recorder-Controller companies.

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

W&SW

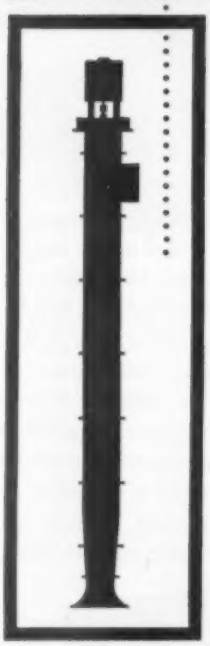
New Equipment

Improved Electronic Line Locator

101

The Wilkinson Products Company, Pasadena, Calif., has announced that an advanced automation method is now being employed in the manufacture of the Wilkinson Line Locator. The new method etches the circuits on a rugged phenolic material, and is said to result in a dependability and uniformity of instrument functioning not possible with the prevailing hand wiring methods.

Besides better over-all quality control there is less variation between one set and another. This permits an interchange of the transmitter of one instrument with the receiver of another. The use of the new, sturdy, phenolic material in the fabrication of the cases increases their resistance to wear. The weight of the new line locator is only ten pounds. Also, subsurface pipes, cables, etc., under frozen ground, ice, or water cover presents no problem to this instrument.



Huge WHEELER-ECONOMY AXIAL FLOW PUMPS

Designed to Establish a Syphon in Pioneer Application at Donaldsonville, La.

To establish water supply from the Mississippi River to the vast area of Bayou La Fourche, required the utmost ingenuity and cooperation between the State of Louisiana engineers and Economy Pumps engineers. Three 42" x 48" Wheeler-Economy AFV Axial Flow Pumps were selected to do the job. Design capacity is 45,000 GPM at 17' TDH. But when these pumps operate as a syphon they move 65,000 GPM. Motors are 250 HP operating at 514 RPM. Pumps in operation run 24 hours a day.

It is believed this is the first application of pumps of this design to pass such a high volume of water on the syphon principle. Infinite care in planning and construction is typified by the exact length each pump had to meet—51 3/4" from underside of mounting plate to end of suction bell. Moreover, every increment assembled in the field had to be made airtight by skilled Wheeler-Economy specialists to make possible the necessary vacuum.

Success was largely assured by Wheeler-Economy's extensive manufacturing facilities in Philadelphia. Here, in one of the largest test pits in the industry, witness tests were made by the State of Louisiana and the contractor to prove pump performance before delivery.

You, too, can rely on Wheeler-Economy for help on complex pumping problems, dependable delivery and performance that lives up to promise.

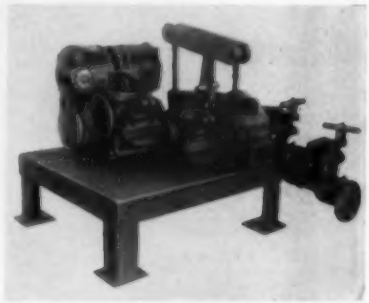
WES13

WHEELER-ECONOMY PUMPS

ECONOMY PUMPS, INC. · DIVISION OF C. H. WHEELER MANUFACTURING CO.
19TH AND LEHIGH PHILADELPHIA 32, PA.

Diaphragm Slurry Pump

102



The Komline-Sanderson Engineering Corporation, Peapack, New Jersey, has announced the new Komline-Sanderson 2" Diaphragm Slurry Pump. The pump is a self-contained unit featuring dual-ball check valve design and variable-speed drive, permitting gentle pumping action, positive feed and metering characteristics and minimizing clogging. Available in capacities ½ to 5 G.P.M., 1 to 10 G.P.M., 2 to 18 G.P.M.

Axial Blower For Sewage Aeration

103

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced the first axial air blower to be used in the United States for sewage aeration work—a 200,000-cfm, free-air capacity, 8½ lb. gauge unit—will be delivered in 1956 to the Sanitary District of Chicago's West-Southwest Sewage Treatment plant at Stickney, Illinois.

According to the company, centrifugal blowers have been used for aeration duty in moderate and large

size plants in the past. However, the high efficiencies of the axial equipment makes it particularly suitable for base load work. The new base load machine will make it possible for the Sanitary District to use existing centrifugal units to carry swing loads.

The blower will be driven by an 8250-hp, 3600-rpm WA-Series steam turbine. In addition to the blower and the turbine, A-C is furnishing a 7500-sq. ft. surface condenser for this installation.

Effluent Sampler

104

Phipps & Bird, Inc., Richmond, Va., has developed an automatic effluent sampler that is designed to take samples periodically from effluent streams, rivers, etc., for compositing and analysis.

Some of the advantages claimed for the new sampler are: compactness and portability; simplicity in manipulation; self-priming pump, lifts liquid to height of six feet; easily regulated by-pass feeder; and low initial cost with practically no maintenance required.

The sampler comes completely equipped with pump and motor, electric timer, compositing bottle, 50 feet of electric cord, electrical accessories, and case. Full operating instructions are furnished and additional electrical outlets are provided for an electric light bulb or heating element in the case.

Adjustable Coupling For Meter Installations

105

Jasco Products Co., Houston, Texas, has developed an adjustable coupling to facilitate meter installations.

The tail piece on the coupling has approximately a ½ inch movement and thus allows relative movement in the pipe connection to the meter so that the meter can be tied together without strain or stress on either the meter or connecting pipe. Only one Jasco coupling is required, replacing the standard coupling and tailpiece, and it may be used on any type meter.

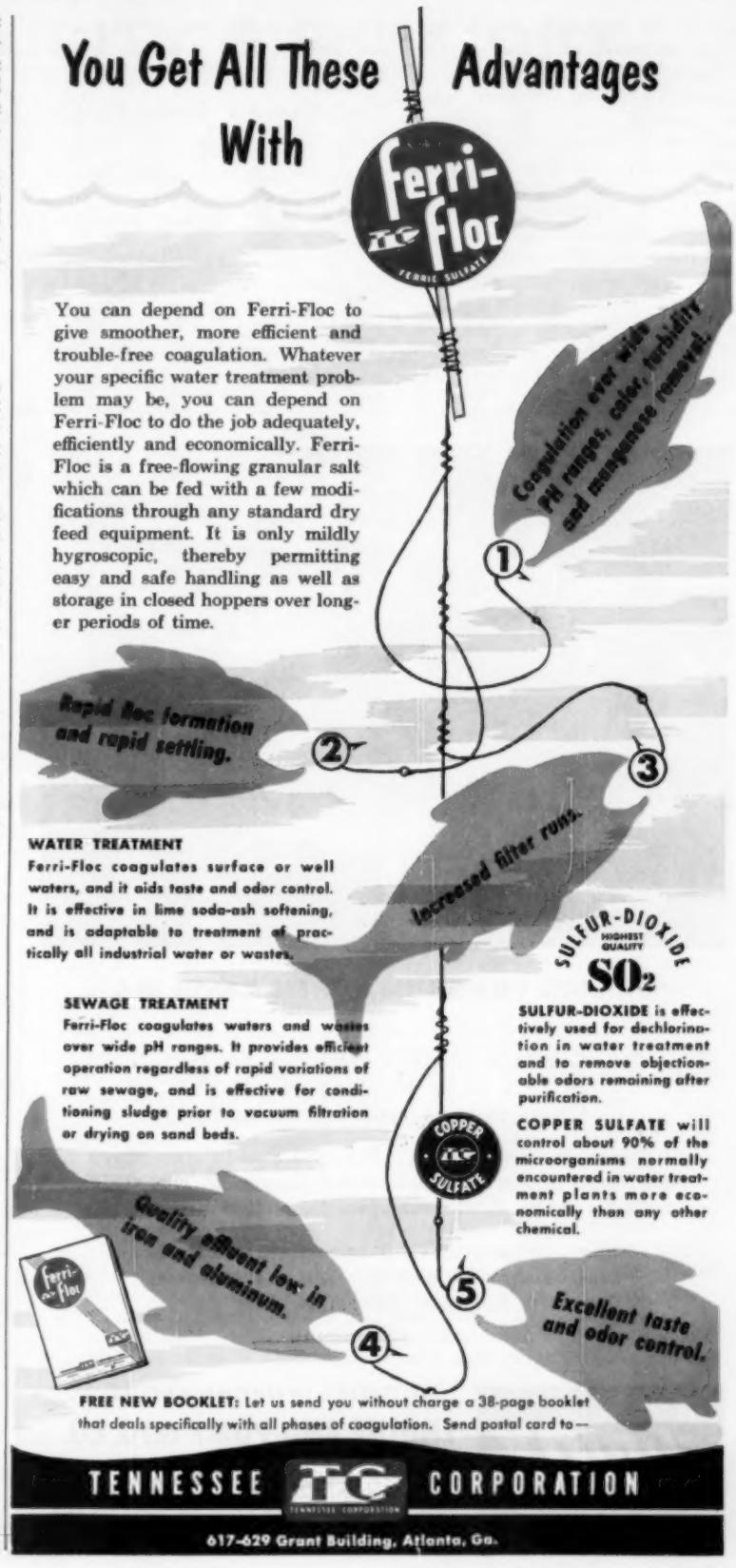
The coupling eliminates the usual "tight spots" and allows great time savings on meter installations or replacements.

Plastic Fittings and Tubing Cut Instrumentation Costs

106

Tube Turns Plastics, Inc., Louisville, Ky., has introduced a new line of instrumentation fittings made of

(Continued on page 94A)


You Get All These Advantages With
Ferri-Floc
You can depend on Ferri-Floc to give smoother, more efficient and trouble-free coagulation. Whatever your specific water treatment problem may be, you can depend on Ferri-Floc to do the job adequately, efficiently and economically. Ferri-Floc is a free-flowing granular salt which can be fed with a few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy and safe handling as well as storage in closed hoppers over longer periods of time.
Coagulation over wide pH ranges, color, turbidity and manganese removed.
1
Rapid floc formation and rapid settling.
2
3
Increased filter runs.
WATER TREATMENT
Ferri-Floc coagulates surface or well waters, and it aids taste and odor control. It is effective in lime soda-ash softening, and is adaptable to treatment of practically all industrial water or wastes.
SEWAGE TREATMENT
Ferri-Floc coagulates waters and wastes over wide pH ranges. It provides efficient operation regardless of rapid variations of raw sewage, and is effective for conditioning sludge prior to vacuum filtration or drying on sand beds.
SULFUR-DIOXIDE
HIGHEST QUALITY
SO2
SULFUR-DIOXIDE is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.
COPPER SULFATE
COPPER SULFATE will control about 90% of the microorganisms normally encountered in water treatment plants more economically than any other chemical.
Quality effluent low in iron and aluminum.
4
5
Excellent taste and odor control.
FREE NEW BOOKLET: Let us send you without charge a 38-page booklet that deals specifically with all phases of coagulation. Send postal card to—
TENNESSEE CORPORATION
617-629 Grant Building, Atlanta, Ga.

unplasticized polyvinyl chloride and, for use with them, corrosion resistant flexible tubing.

According to the company, these new products permit an entire assembly to be put together by hand without the aid of wrenches, flaring or bending tools, or stretchers. And no sleeves or ferrules are involved. All that is needed is a knife or scissors to cut the tubing to the proper length.

The new fittings will hold burst pressures in excess of those to which the flexible tubing may be subjected, and they cannot be overtightened by hand. The tubing itself is practically inert and is not affected by most acids and alkalies.

2,000-Watt A.C. Electric Plant

107

D. W. Onan & Sons Inc., Minneapolis, Minn., has developed a new "heavy duty" electric generating plant.

The Onan Model 2LK produces 2,000 watts, 60-cycle, A.C. at 1800 RPM (or 1500 watts in 50-cycle) in all standard frequencies and phases. An extremely compact unit, weighing 235 pounds, the LK unit was built specifically for rugged, heavy duty service on scores of jobs requiring economical, long-life performance in an independent source of electric power. It is a tough little unit that can take rough handling on mobile and portable jobs, and stand up under long hours of continuous service.

Small-Size Receivers and Gauges

108

Republic Flow Meters Company, Chicago, Ill., has introduced a new line of small-size receivers and draft, pressure and temperature gauges.

Called the V-5 Series, the new gauges are said to give excellent readability and accuracy with a scale measuring only five inches high. Each V-5 Gauge is an individual, self-contained measuring unit which may be mounted separately or grouped together with as many as eight units in a single case. All standard draft ranges, pressures up to 100 psi and temperature to 1000°F. may be measured directly with V-5 Gauges. Bellows models may be used to receive standard output pressures from pneumatic transmitters and controllers.

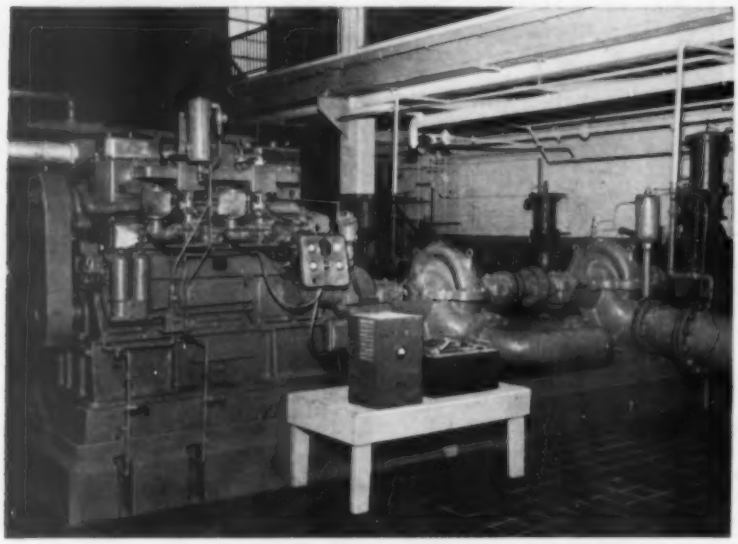
Mobile 20,000 GPH Centrifugal Pump

109

Rice Pump & Machine Co., Belgium, Wis., has announced a new model in the company's line of centrifugal pumps, that pumps 20,000 GPH. Although the new pump is basically designed for use with a 15 HP, twin cylinder engine, the frame size and design does permit the use of a single cylinder gas engine, diesel engine or electric motor.

Rubber-tired wheels are 20 x 4 inches. Steel wheels or skids may be

(Continued on page 96A)



CLIMAX POWER IN NORTH CAROLINA

Goldsboro, North Carolina, insures the certainty of its water supply with this Climax powered auxiliary pumping unit.

A Climax model R61 engine is direct connected to two Morris centrifugal pumps in series having a capacity of 2100 GPM against a 210 ft. TDH when operating at 1200 RPM.

Plant designed by and constructed under the supervision of William C. Olsen and Associates, Consulting Engineers, Raleigh, N. C.

climax

FOR COMPLETE INFORMATION, WRITE TO . . .

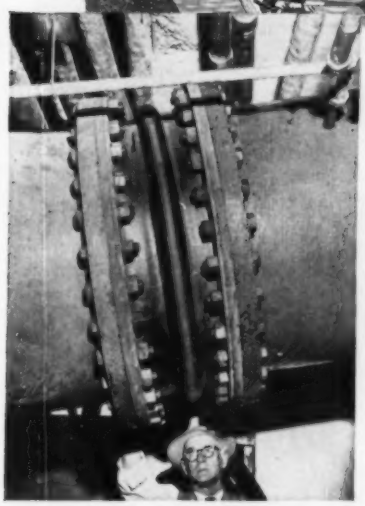
ENGINE AND PUMP MFG. CO.

208 So. La Salle St.

CHICAGO 4, ILLINOIS

Factory—Clinton, Ia. *District Office*—Dallas, Tex.

KEEPING A CITY'S FEET DRY...



Note great size of this U. S. Expansion Joint installed on a generator in the New Orleans S&WB plant at Eagle and Spruce Streets

for over 26 years U. S. Rubber Expansion Joints have been doing just that!

New Orleans is a city nestled in a saucer. Surrounded on all sides by water, many of its areas are below sea level. Add to this, one of the heaviest rainfalls in the country (as much as 15 inches in 17 hours) and you can see that this glamour city could easily be flooded.

But the New Orleans S&WB* keeps the city's feet dry by means of a pumping system that carries off the rain. Turbo-generators supply the power not only to operate this drainage pumping system but also the separate sewage pumping and the water supply systems.

26 years ago, one of these turbo-generators *(in use 98% of the time)* was equipped with 5 United States Rubber Company Expansion Joints. Why? To allow for contraction and expansion in pipe lines, and to counteract vibration. Says the Chief engineer of the S&WB: *"The U. S. Joints have never failed in all that time.* If any of them ever had, the turbine would be out of use."

U. S. Expansion Joints are widely used in the pipe lines of utility generating plants, municipal water supply systems, office and apartment buildings, ships—wherever pipe lines have to be protected against vibration, contraction and expansion. These joints soon pay for themselves by eliminating expensive maintenance and replacement in pipe lines. They eliminate noise. Once installed, you can count on years of trouble-free service. Obtainable at any of the 27 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

US RUBBER

Mechanical Goods Division

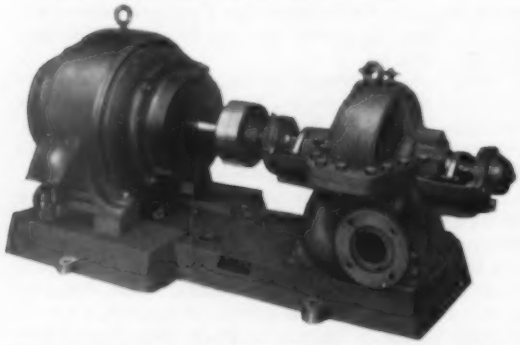
United States Rubber

easy to find

...BUT hard to supply

Man's most vital need, water, poses a problem to communities everywhere . . . population increases and industrial expansion have strained distribution systems to the limit.

Efficient WEINMAN Centrifugal Pumps are capable of . . . and deliver . . . continuous, reliable pumping service for any type of water distribution system, operating over long periods of time without major maintenance. A wide range of WEINMAN Centrifugal Pumps are available in models for both low and high heads, in single or double-stage, in capacities to suit industrial and civic requirements. A WEINMAN Centrifugal Specialist is no farther away than your phone; his expert knowledge will insure success in overcoming your pumping problems, large or small. Write, wire or phone.



WEINMAN TWO-STAGE SPLIT-CASE PUMP for high head service—capacities up to 600 gpm. Single Stage types—capacities up to 4,000 gpm.

Representatives in principal cities.

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

266 SPRUCE STREET • COLUMBUS 8 • OHIO

substituted for the rubber tires to meet varying field conditions. A lubricated, mechanical seal of the manufacturer's own special design affords positive, leak-proof protection between shaft and impeller plate. The seal is spring loaded to compensate for wear.

Excavator and Bulldozer Attachment

110

Pippin Construction Equipment, Inc., White River Junction, Vermont, has developed a new model Excavator and Angling Bulldozer for mounting on the International 300 utility tractor.

The new excavator digs to a depth of over ten feet and loads trucks to a height of nine feet with back hoe bucket, and twelve feet with a shovel bucket. The mounting incorporates an exceptionally strong sub-frame running the entire length of the tractor.

The angling bulldozer features heavy tubular push arm construction along with a low pivot point for effective dozing operation. The blade is available with angling bracket for quick angling 12½ or 25 degrees left or right. Down pressure, exceptionally high raised clearance, and dozing effectiveness are featured.

Miniature All-Purpose Timer

111

Automatic Temperature Control Co., Inc., has developed the Atcotrol, a new all purpose automatic reset timer for use in water conditioning systems, sewage plants, filter reversals, motor and valve controls.

A one-piece injection-molded acrylic front piece, serving a dual purpose of dust-proof cover and seal for dial. Large knurled adjusting knob with integral time setting pointer are a unitized part of the dial and cover assembly.

The timer can be completely serviced with an ordinary screw driver and set screw wrench. All timing ranges use the same internal operating mechanism, housed in basic chassis and cover, and with interchangeable dials and motors makes possible 10 timing ranges from 0 to 15 seconds, with minimum setting of ¼ second, to 0 to 240 minutes with minimum setting of 240 seconds. Dial and motor can be changed in matter of three minutes.

QUICK INSTALLATION OF AMVIT JOINTED CLAY PIPE SOLVES SEWER PROBLEM FOR CAMDEN, N. J.

City Engineer
George Rogers

Assistant City Engineer
John Morgan

Contractor
C. & T. Affiliates, Inc.
John B. Kelly, President

New Amvit Jointed Clay Pipe saved considerable time and money for Camden, New Jersey.

The installation of this 15-inch sewer was done quickly and easily. The pipe was delivered ready for the ditch with the Amvit joint "built-in".

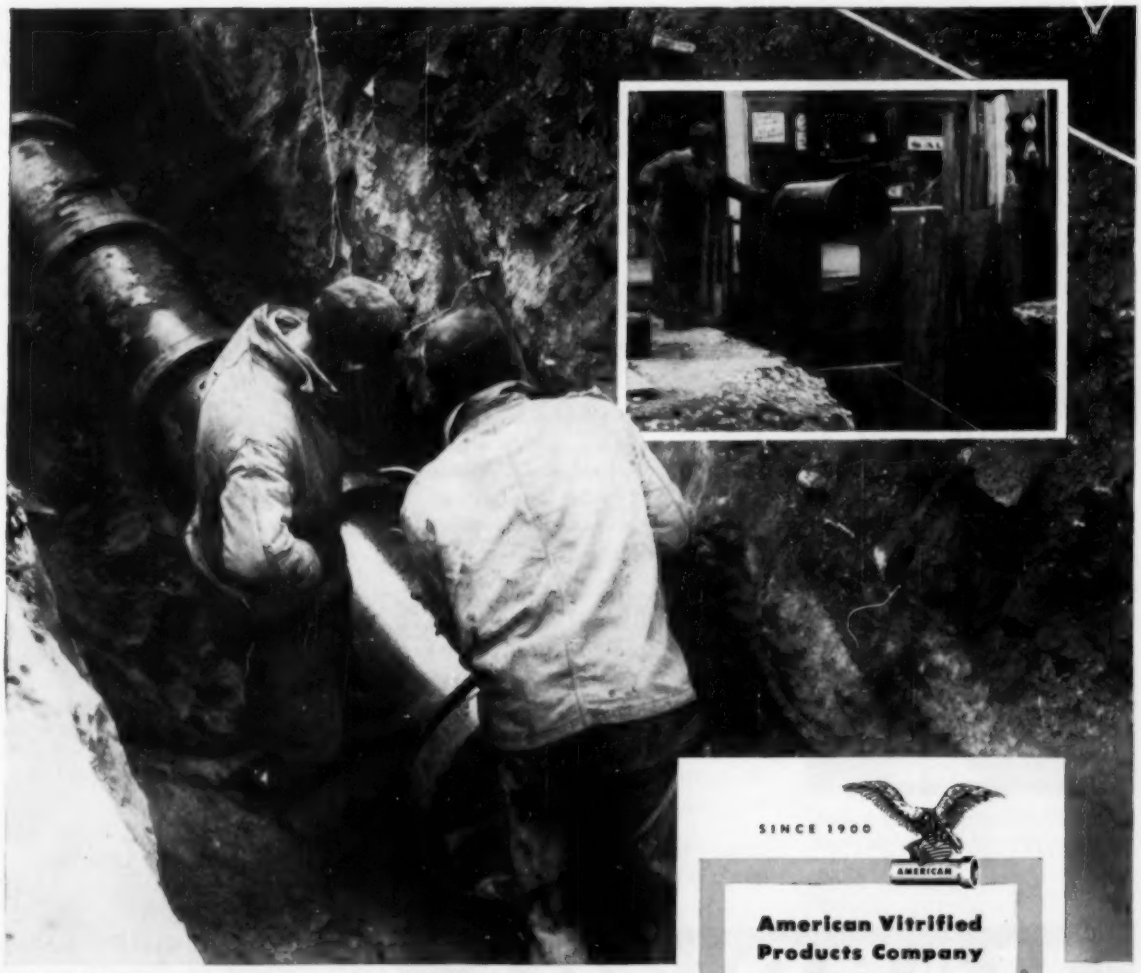
When the pipe is "pushed" together, the joint is in constant compression. Water cannot force its way in or out. Because this joint is flexible, immediate backfilling was possible.

Cut costs of *installed* pipe. Prevent costly infiltration. Stop pumping and treating thousands of gallons of ground water.

Specify easy-to-install, permanent Amvit Jointed Vitrified Clay Pipe.

Amvit Jointed Clay Pipe is just one of the many products manufactured in our plants across the nation. American Vitrified Products Company also produces concrete pipe, clay pipe, liner plates, flue liners and wall coping—both glazed and unglazed.

For more information, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.



The Amvit joint is made of a new acid resistant plastic material with rubber characteristics. Like the pipe, the joints will not be harmed by any condition of underground service. The pipe is simply pushed together. The trench is then ready for backfilling.

SINCE 1900

AMERICAN

American Vitrified Products Company

CLEVELAND, OHIO

Patent Pending

Plants Across the Nation... Brazil, Indiana • Chicago, Illinois • Cleveland, Ohio • Crawfordsville, Indiana • Detroit, Michigan • East Liverpool, Ohio Fenton, Michigan • Grand Ledge, Michigan • Lisbon, Ohio • Los Angeles, California • Milwaukee, Wisconsin • South Bend, Indiana • Uhrichsville, Ohio

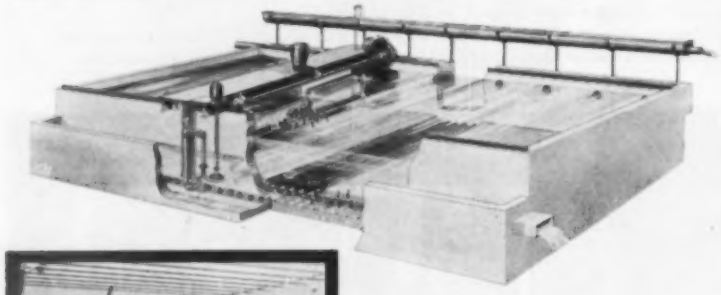
W&SW

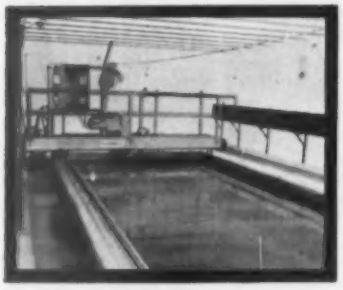
Manufacturers' News

Expansion at Graver

The Graver Water Conditioning Co. has announced an expansion of its offices at 216 W. 14th Street, New York. A large portion of office space in its present location has been added to that already occupied by Graver. Along with the acquisition of new space Graver has just completed a complete redecoration of all its offices.

Mr. H. T. Sulcer, vice president and general manager of Graver, explained that the steady growth of the Graver organization necessitated the expansion. The new space will be taken up by increased personnel and will permit Graver to offer a greater degree of personal service to customers and clients.





12½' x 40' Hardinge Automatic Backwash Sand Filter in a municipal water plant in Vermont.

12½' x 86' Hardinge Filter handling water supply for a Canadian paper plant.

A sand filter which

CLEANS ITSELF

The Hardinge Automatic Backwash Sand Filter is a complete departure from standard filtration equipment, in that it backwashes its filter bed automatically without interrupting normal filtration.

The ABW filter in combination with flocculation and sedimentation equipment provides treated and filtered water for municipal and industrial water supplies.

The filter may be applied also for the treating of plant waste water, for reuse or disposal.

Complete specifications upon request. Bulletin 246-A-15.

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco

Rice Elected Director Of Hagan Corp.

Hagan Corporation, Pittsburgh, Pa., has announced that Owen Rice, vice president in charge of industrial chemical sales for the company, has been elected a director of Hagan and its subsidiaries, Calgon, Inc., Hall Laboratories, Inc., and The Buromin Company.

Mr. Rice fills a vacancy on the board created when E. M. Chaney retired as company treasurer and director.

Joining the Pittsburgh instrument and control firm in 1937 as a chemist, Mr. Rice since 1949 has been in charge of selling Calgon and companion products for water conditioning and processing uses in a wide variety of industries. He also has directed sales of Calgon products used for municipal water conditioning, for food processing, and in the field of commercial detergents.

McCauley Joins Hammond Iron

Hammond Iron Works, New York, N. Y., has announced the appointment of John C. McCauley to the sales engineering staff.

Mr. McCauley, who has been identified with the metal fabricating industry for the past eleven years, will make his headquarters in New York City.

Barbour Promoted by Fairbanks-Morse

Fairbanks, Morse & Co., Chicago, Illinois, has announced the appointment of Henry J. Barbour as Manager of Advertising and Public Relations for the company. He succeeds L. A. Harlow who has resigned to join an advertising agency.

Mr. Barbour has been associated

(Continued on page 100A)

Consulting engineer for the Northwest Pumping Main: Gilbert Associates, Inc. *General Contractor:* Berlanti Construction Co., Inc.

7-Mile Pumping Main Under Way in Reading, Pa.

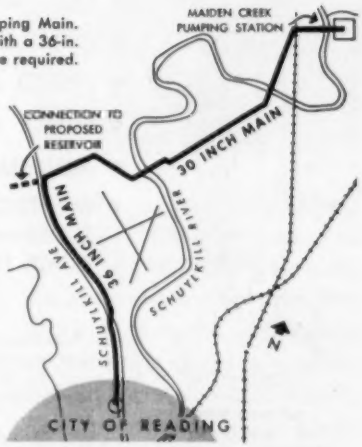
The City of Reading, Pa., a growing community of 135,000 people, is engaged in a broad program of water-supply improvement. A key phase of this program is construction of the Northwest Pumping Main, a 37,000-ft steel line supplying water from Maiden Creek Pumping Station to the center-city area, and providing connections with two large reservoirs soon to be built.

The major portion of the line consists of Bethlehem Tar-Enameled Steel Pipe in 36-in. and 30-in. diameters. The pipe was fabricated, coated, lined and wrapped at our Steelton, Pa., plant, and supplied in 40-ft lengths. In the field three 40-ft lengths were butt-welded together adjacent to the trench to form 120-ft sections. These long sections were then lowered into the trench and joined with mechanical couplings.

We suggest that you consider Bethlehem Tar-Enameled Steel Pipe for your next water-main project. Steel pipe is strong and resilient, well able to withstand shocks from both external and internal forces. And remember that each steel pipe is actually hydrostatically tested in the shop, ordinarily to twice the working pressure!

Bethlehem Tar-Enameled Steel Pipe is available in all diameters from 18 in. to the largest permitted by common carriers, and in 40-ft lengths. The nearest Bethlehem sales office would be happy to give you detailed information.

Map shows the route of Reading's Northwest Pumping Main. The 30-in. line from the pumping station connects with a 36-in. main. Three crossings under the Schuylkill River were required.



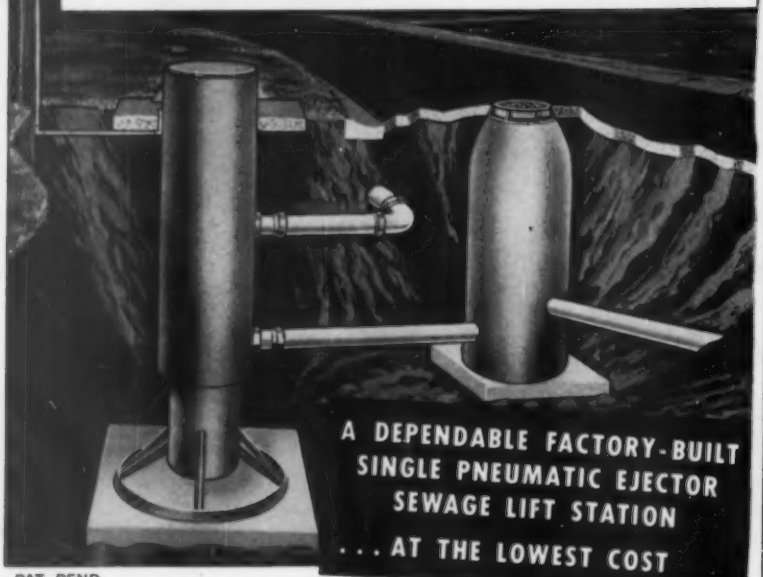
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

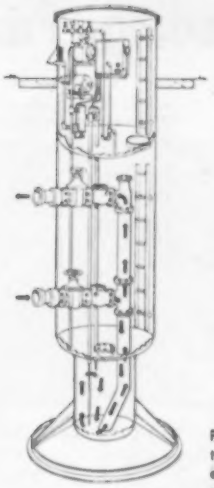
BETHLEHEM STEEL

Have you considered . . .
The Smith & Loveless "MON-O-JECT"?



PAT. PEND.

FOR FACTORIES • SCHOOLS • MOTELS • AND SMALL SUB-DIVISONS



INTERIOR VIEW OF "MON-O-JECT" SHOWING COMPLETE PARTS AND ACTION

CAPACITIES: 20 G. P. M. to 100 G. P. M.

- FACTORY ASSEMBLED AND TESTED
- COMPLETELY AUTOMATIC
- TESTED AND PROVEN IN SERVICE
- EASILY AND QUICKLY INSTALLED
- MINIMUM MAINTENANCE
- UNDERGROUND INSTALLATION ELIMINATES UNSIGHTLY PUMP HOUSE

For Job Recommendations, complete specifications, and drawings — all part of the latest edition of the 100 page Smith & Loveless pump station Data Manual . . . .

WRITE DEPARTMENT 20

S&L Smith & Loveless, Inc.
P. O. BOX 8172 • KANSAS CITY, MISSOURI
MANUFACTURING PLANT: MERRIAM, KANSAS

REPRESENTATIVES IN PRINCIPAL CITIES

with Fairbanks, Morse & Co. for thirty-one years, having held numerous positions both in the firm's Beloit, Wisconsin, works and the executive offices in Chicago.

Roberts Filter Quarter Century Club Holds Banquet

Roberts Filter Manufacturing Company, Darby, Pa., has announced that the eighth Annual banquet of the company's Quarter Century Club was held in November for employees who have served the company for 25 or more years. The club membership consists of 27 service and 3 honorary members.

At the banquet, Mr. Harold W. Pugh was elected President and John W. Burton was elected Secretary of the club for the coming year.

Parnell Named Manager Of Acipo Minneapolis Office

American Cast Iron Pipe Company, Birmingham, Ala., has announced that L. C. Parnell has been appointed Manager of the company's Minneapolis Sales Office, succeeding D. W. "Doug" Wallace, who retired in October.

Mr. Parnell has been connected with Acipo for the past twenty years, the last six of which have been spent in the Minneapolis office. He began in the Mono-Cast plant in Birmingham in 1935. His experience includes work in the Foundry, Melting Department, Experimental Department, Sales Engineering, Dallas Sales office, Chicago sales office and Southern sales in Birmingham. In 1941, he went on active duty with the U. S. Army, where he served five years.

Sales Organization Changes At S. Morgan Smith

The S. Morgan Smith Company, York, Pa., has announced the realignment of its Valve Division Sales territories made necessary by the recent death of Maxfield Pease, District Manager of the Northeast Territory, Cleveland.

In the consolidation of that territory, Maurice H. MacDonald, Middle Atlantic District Manager, will assume charge of the area from Boston to Pittsburgh. Chicago District Manager J. Harold Whisler will now cover the western part of the former territorial division including Cleveland,

Detroit, Cincinnati and Indianapolis. George A Baer, application engineer in the company's home office, has been named Assistant District Manager of this territory and will move to Chicago to assist Mr. Whisler.

The company also announced that Moody-Price, Inc., Baton Rouge, La., as representative for its valve division in the Louisiana-Southern Mississippi territory. Mr. Jere Price and Mr. Ray Moody will represent the company in this territory.

Simplex Appoints Holzwarth Advertising Manager

Simplex Valve & Meter Co., Lancaster, Pa., has announced that Mr. Joseph C. Holzwarth, Jr., has been appointed to the position of Advertising Manager.

Mr. Holzwarth received his BS degree in Chemistry in 1936 from Franklin and Marshall College and first worked for the Armstrong Cork Co., Lancaster. He went into the service in 1942 and upon return, went with the DeWalt, Inc., Co., in their advertising and sales department.

In 1950, he was recalled for active duty as a Captain and during his tour of duty in Europe performed public information and public relations work in Southern Germany. Released in 1954, he then spent several months with the 28th Infantry Division of the Pennsylvania National Guard as the administrative plans and training officer before joining Simplex.

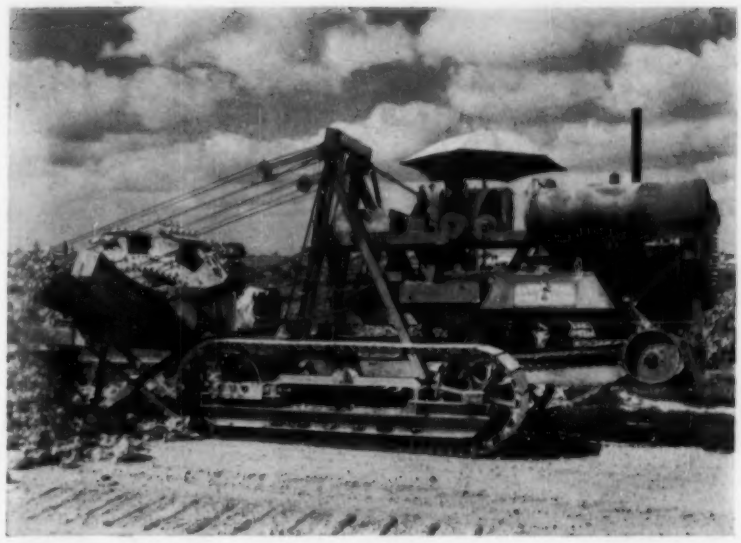
Neptune Meter-Eastern Industries To Merge

Neptune Meter Co., New York, N. Y., has announced that the Directors of Eastern Industries, Inc., manufacturer of radar speed meters and producers of 80% of vehicle actuated traffic controls, has accepted the proposal of Neptune to combine the two companies.

Under the proposal, subject to stockholder approval at special meetings of the two companies in early 1956, the reorganization would be worked out on the basis of 10 shares of Eastern common for 6 shares of Neptune common.

For Neptune the move means further expansion and diversification in the field of electronics. In 1954 Neptune acquired Revere Corp. of America, and Cox and Stevens Electronics

(Continued on page 102A)



Cleveland "140" *halves* 90-day time limit...digs 44,500 feet Florida coral rock in 45 days

Under contract to dig over 8 miles of water line trenches within 90 days, C. B. S. Excavators of Miami finished the job in just half that time using a fast-moving Cleveland "140" Trencher.

The "140" cut trench through solid coral rock for over 40,000 feet of lines in Miami's Westview Homes Subdivision and for the mile-long main connecting the system to the water plant. Trench for the 6-, 8-, 10- and 12-inch pipe was 20 inches wide and 42 inches deep. In addition to the extensive coral rock, the trenching operation was further complicated by seepage of water into the partially-dug trench in some areas of the subdivision.

"No other machine can match it," owner P. F. Chambers says of his Cleveland "140". "For its size this machine can do more trenching than any other. We use the same machine for digging utilities lines and house footings. It really does a fine job of cutting to grade."

See your local distributor

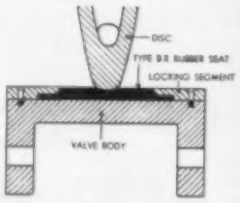
THE CLEVELAND TRENCHER COMPANY • 20100 St. Clair Ave., Cleveland 17, Ohio

CLEVELAND

Be Sure of DROP-TIGHT CLOSURE

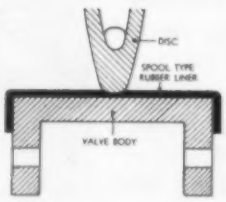
Valve with *Rubber Seat*

In this Rockwell butterfly valve the stainless steel edge of valve disc presses at 90° into thick, precision-molded Type B-R rubber seat, which is clamped in position by removable metal locking segments. Shaft of stainless steel (or other metal). Bearings—lifetime, heavy duty graphite-lubricated, sleeve type. No corrosion or contamination. Meets AWWA specifications for 25, 50 and 125 p.s.i. butterfly valves.



Valve *Rubber-Lined*

Valve with rubber spool liner—natural or synthetic, hard or soft—vulcanized and cemented to valve body. Preferred where fluid may affect cast iron or fabricated steel construction.



Other Advantages

- Minimum Restriction to Flow
- Self-Cleaning—No Debris-Collecting Pockets
- Compact • Lighter Weight
- Require Less Space
- Easier to Install

W. S. Rockwell Butterfly Valves are made in sizes from 4" to 144"; cast iron, fabricated steel or alloy construction. Furnished with any manual or automatic operator.

W. S. ROCKWELL COMPANY

BUTTERFLY VALVES • SLIDE VALVES • AUTOMATIC VALVES

2826 ELIOT STREET • FAIRFIELD, CONN.

Sales Representatives in Principal Cities

Scales. In 1955, Superior Meter Co., a gas meter firm, with a plant in Brooklyn and another under construction in Punxatawney, Pa., was acquired by Neptune.

Nanney Transfers From General Filter

General Filter Company, Ames, Iowa, has announced that Mr. Wiley H. Nanney, Field Construction Superintendent, has been transferred to the Layne-New York Company, Inc., at Linden, New Jersey. Nanney joined the General Filter Company staff as construction foreman in 1935. He has supervised the installation of over 500 water treatment plants throughout the United States.

He will be representing Layne in the capacity of General Field Superintendent, Water Treatment Division. His new duties will include the installation of water conditioning equipment in Pennsylvania, New York, New Jersey and the New England States.

Infilco Forms New Division

Infilco Inc., Tucson, Arizona, has announced the organization of an entire new division, the Ion-Exchange Division.

The new division will be under the supervision of Mr. Howard W. Frazer, a graduate of Iowa State in Chemical Engineering, who joined Infilco in 1936. He has been a leading field engineer for the company since 1949, specializing in ion-exchange treatment. His experience includes close association with many of the largest ion-exchange treatment plants in states bordering the Great Lakes.

Conoflow And Walworth Company Merge

Conoflow Corporation, Philadelphia, Pa., has announced an exchange-of-stock agreement between Conoflow Corporation and the Walworth Company. As a result of this agreement, Conoflow will become an operating subsidiary of the Walworth Company.

As an independent subsidiary, Conoflow will operate under the same policies as in the past, with no change in management or personnel, and will remain at its existing plant at 2100 Arch Street, Philadelphia, Pa.

Atlas Mineral Appoints Sales Representative

The Atlas Mineral Products Company, Mertztown, Pennsylvania, has announced the appointment of Charles Jensen as Regional Sales Representative in Northeastern United States for

pipe jointing compounds. Before joining the company, Jensen was connected with Emeral Manufacturing Company as sales representative for nine years. Prior to that time, he was Assistant Plant Manager of Ranger Aircraft Engines.

Jensen's territory will include the New England and Middle Atlantic States. He will promote the use of G-K, bituminous sewer pipe jointing compound, JC-60, the newly developed plastic base sewer pipe jointing compound, and MINERALEAD, the jointing compound for cast iron bell and spigot water pipe.

Horth Promoted By De Laval

The De Laval Steam Turbine Co., Trenton, N. J., has announced that Mr. John D. Horth has been appointed Assistant Manager of the Compressor Sales Department.

Mr. Horth joined De Laval in 1947. He served in the Chicago sales and service headquarters until 1949, when he was named District Manager of the St. Louis office. In 1951 he was transferred to the Compressor Sales Department in Trenton.

Warren Foundry To Build Cast Iron Pipe Shop

Warren Foundry and Pipe Corporation, New York, N. Y., has announced the construction of a modern cast iron pipe shop for completion next spring, on the occasion of the Company's hundredth anniversary. This shop will be an integral part of the Company's Phillipsburg, New Jersey, Division and will utilize the deLavaud process of centrifugal spinning in metal molds for pipe sizes 4 through 12 inches in diameter.

Other Warren operations include a sand-spun cast iron pipe foundry in Everett, Massachusetts, the Mount Hope iron ore mines, the oldest in the United States, and a crushed stone plant, also in Mount Hope, New Jersey.

Beaver Appoints Vaught District Manager

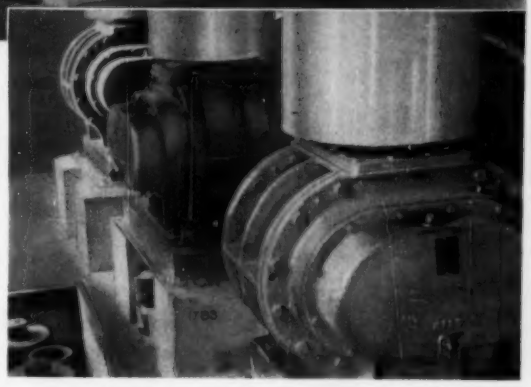
Beaver Pipe Tools, Inc., Warren, Ohio, has announced the appointment of Mr. William H. Vaught, Sr., as District Manager for the Beaver firm.

His territory will include Kentucky, West Virginia, Southern Ohio and Southern Indiana.

Mr. Vaught attended the University of Kentucky. He is a mechanical engineer by profession. Before joining Beaver, he was for-

(Continued on page 104A)

↑ One of two R-C Rotary Positive Blowers in large metropolitan sewage treatment plant. Capacity of each blower is 5,860 cfm.



In this rural southern community, three small R-C Blowers (capacity 350 cfm each) provide completely dependable performance.

BIG CITIES AND SMALL TOWNS PROFIT FROM R-C *plur-ability*

Freedom from maintenance cost and completely dependable performance are two of the important factors which make up the *"plur-ability"* of Roots-Connersville Blowers for sewage treatment. Add to these the wide range of sizes and capacities . . . choice of Rotary Positive or Centrifugal types . . . extremely low operating cost . . . flexibility of drives . . . and capable engineering service in the selection of equipment.

These values account for the overwhelming choice of R-C Blowers and related equipment for public or industrial waste treatment. Ask for details for installations being planned or under consideration, and see why R-C *plur-ability* pays off in any size plant.

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

156 Mount Ave., Connersville, Indiana. In Canada — 629 Adelaide St., W., Toronto, Ont.

merly associated with a large Chicago tool manufacturer as territory sales representative.

Vaught's office and residence are in Cincinnati, Ohio.

Mueller Appoints Seevers To Sales Staff

Mueller Company, Decatur, Illinois, has announced the appointment of F. R. Seevers as Sales Representative in the Colorado, Wyoming, Montana Territory.

Mr. Seevers succeeds Ray Fallon, Jr. Seevers is well-versed on the complete Mueller line having had previous field sales experience, as well as being in charge of their complete training program at the factory for the past three years.

Combustion Engineering To Build Nuclear Engineering And Development Center

Combustion Engineering, Inc., New York, N. Y., has announced that it has contracted for the purchase of a 530-acre site in Windsor, Connecticut, on which it will build a Nuclear Engineering and Development Center.

The center will comprise facilities for the complete design and development of nuclear power reactors, for the construction of reactor cores, and for the manufacture of related atomic fuel elements. Costing upwards of 5 million dollars, the center will begin operations late next year and by 1957 will employ several hundred people in its various departments, largely engineers, scientists and technicians. Stone & Webster Engineering Corporation have been engaged to serve as architects and engineers.

Toledo Pipe Acquires Thread-Ezy

The Toledo Pipe Threading Machine Company, Toledo, Ohio, has announced the acquisition of the Port-A-Pony portable power drive. The Thread-Ezy Company, now a subsidiary of the Toledo firm, will continue to manufacture the Port-A-Pony at their Michigan plant with complete distribution handled through the world-wide distributor organization of the Toledo firm.

The Port-A-Pony, originally designed as a lightweight, portable power drive for pipe threading and cutting, may be used for countless other applications as well. Basically it consists of a worm and ring gear assembly powered by a reversible ½ hp motor through a gear train, and housed in a magnesium alloy housing.

BIG valve...little space

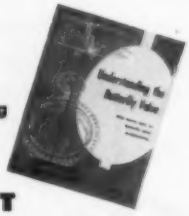
The disc in this 84-in. low pressure Butterfly Valve must withstand 138,000 lbs. of force when closed against a 25 P.S.I. line pressure . . . yet the face to face dimension is only 18 in. and the entire valve weighs just 12,000 lbs. Even under this severe loading Pratt design keeps the bearing pressure well below 2500 P.S.I.

Pratt Rubber Seat Butterfly Valves are manufactured in sizes from 10 in. to 168 in. in diameter, in pressure ratings up to 125 P.S.I. Their low initial cost, easy installation and proven low maintenance make them the logical solution to valving problems, both for new projects and as replacements.

The Henry Pratt Company originated and has been making this type of valve for over 28 years. Our background represents the greatest cumulative experience in the industry. It is the reason why Pratt Valves are so convenient to install, easy to operate and give long years of trouble-free service. **For full details write for Bulletin 1-C.**

HENRY PRATT

Send for informative booklet "Understanding Butterfly Valves."



RUBBER SEAT

Butterfly Valves

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

Literature & Catalogs

Remote Control Systems For Water Supply

112

Taller & Cooper, Inc., Brooklyn, New York, has released a bulletin on **Remote Control Systems** for the automatic operation of municipal water supply systems.

The bulletin contains a case history of how a major municipal water district, faced with the problem of rapidly expanding population and exorbitant water rates solved its problem by installing a Taller & Cooper automatic deep well water supply system.

Photographs of other installations and a flow chart showing how the system operates are also included.

Tight-Closing Rubber Seated Butterfly Valves

113

Builders-Providence, Inc., Providence, R. I., has just released a four-page colored bulletin on the company's **Butterfly Valves.** According to the bulletin, these valves offer minimum space requirements, drop-tight performance and meet all American Water Works Association design specifications.

In addition to containing descriptive product and installation photos, the bulletin includes design information on the valve sizes, components, type operators, accessories, and lists other main advantages.

Closed Tank Level Measurement

114

The Foxboro Company, Foxboro, Mass., has just issued a new 8-page bulletin describing closed tank liquid level measurement and control with the recently announced Type 13 LA d/p **Cell Liquid Level Transmitter.**

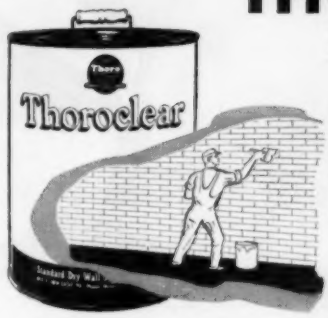
According to the bulletin the Type 13 LA is essentially the same as the familiar force balance differential pressure flow transmitter, except that a simple range suppressor spring has been added to the basic mechanism. The spring balances out the effect of hydrostatic pressure in the piping line from the high point of the tank. Transmitter is fully adjustable for measurements

(Continued on page 106A)

The THORO System
of Masonry Protection

THOROCLEAR

Invisible Water Repellent



Ask your dealer about this powerful silicone water repellent developed by years of research by General Electric Company and now produced by us for your protection. *Ask for Circulars No. 30 and 31.*

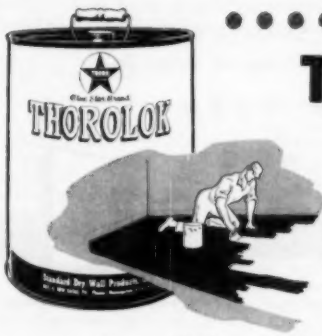
No change in color or texture of brick, limestone, sandstone, tile or stucco surfaces. Applied by brush or spray.

Keep water out of your masonry walls and protect interior plaster, paints and expensive furnishings.

THORITE

20 Minute Set Patching Compound

Repair those broken sills, steps, concrete floors, chimneys and other defective masonry! *Ask for circular No. 20.*



THOROLOK
NO. 100

Use it for your basement or factory floors. New, with special alkali resistant pigments. *Ask for Color Card 32-C.*

Manufacturers of

WATERPLUG, THOROSEAL, QUICKSEAL

for all types of masonry protection!

GET OUR PICTORIALLY DESCRIBED LITERATURE "HOW TO DO IT"

STANDARD DRY WALL PRODUCTS, INC.
NEW EAGLE, PENNSYLVANIA

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

This 40 page book gives useful information, charts, data and instructions on water meter testing. Should be in every meter shop. Available on request without charge or obligation.

SEND FOR YOUR COPY

THE FORD METER BOX COMPANY, INC.
WABASH, INDIANA

FOR BETTER WATER SERVICES FORD

HYDRO-TITE

DEPENDABLE JOINTING COMPOUND

Seals Bell and Spigot Water Mains

Economical—Effective

Over 35 Years Of Dependable Performance

HYDRAULIC DEVELOPMENT CORP.

MAIN SALES OFFICE 50 CHURCH ST., N. Y. C.

General offices and works W. Medford Sta., Boston, Mass.

up to the equivalent of 250″ of water without change of parts.

In addition to diagrams showing principle of operation and suggested installation layout, the bulletin lists complete specifications and dimensions. Also included are illustrations of other Foxboro liquid level components such as indicators, recorders and control valves.

Painting Guide For Water And Sewage Plants

115

Inertol Co., Inc., Newark, New Jersey, has available the **Engineers' Painting Guide For Sewage Plants and Water Works.**

This informative 28-page booklet contains complete water and sewage plant painting specification charts, covering both the standard form plus recommendations by specific units of equipment.

A discussion of Inertol's products for use in water and sewage plants, items of importance to the specification writer and a list of consulting engineers who have specified Inertol coatings are also included.

Turbo-Blowers For Agitation

116

The Spencer Turbine Company, Hartford, Conn., has just published a 4-page bulletin entitled **"Clean Air for Agitation of Liquids."**

The bulletin describes Spencer Turbo-Blowers in sizes up to 250 HP for step aeration, activated sludge, chamber aeration, air blowback, washing grit, air flotation of solids and greases, and process work such as plating.

Performance curves, specification data, and a description of the application of vacuum cleaning to sewage plants are included.

Oxygen Analyzer

117

Arnold O. Beckman, Inc., South Pasadena, California, has just released a new brochure that describes the **Beckman F3 Oxygen Analyzer** in detail.

The brochure shows how the F3 makes its measurement directly upon the oxygen content of the gas —not upon some remote secondary relationship. According to the brochure, the measurement is based upon the paramagnetic properties of oxygen itself, resulting in sensitivity, accuracy and simplicity that surpasses any other method of oxygen measurement. The operating principle is clearly illustrated, typical applications in a wide range of

industries are highlighted, and helpful technical data are also given.

J-M Products Handbook

118

Johns-Manville, New York, N. Y., has released a new 52-page handbook on **Johns Manville Products.** The handbook features eleven lines of J-M products for industry —Insulations and Refractory Products; Transite Asbestos-Cement Pipe; Packings and Gaskets; Electrical Products; Celite Diatomite Filter Aids and Mineral Fillers; Celite Diatomite Catalyst Carriers and Metal Raschig Rings; J-M Synthetic Silicates; Friction Materials; Pipe Protection Materials; Floorings; and, Roofing and Sidings.

The handbook contains not only product descriptions and essential engineering data but also a great deal of valuable related information. For instance, on the subject of thermal insulation problems, the handbook gives methods of calculating heat transmission, tables on heat losses from bare surfaces and equivalent thicknesses of pipes; and, graphs on surface resistance for both pipes and flat surfaces.

Portable Gas Detector

119

Johnson-Williams, Inc., Palo Alto, California, has available a leaflet on their **Combustible Gas Indicators.**

Discussed in this literature are two new features of convenience and advantage, including an automatic shutoff to minimize battery drain, and a sample-drawing system designed to minimize operator fatigue. Illustrated in use, the unit is described with numerous of the accessories which are available for special requirements. A price list covers complete instruments and auxiliary units.

Condensed Laboratory Catalog

120

Fisher Scientific Company, Pittsburgh, Pa., has just issued a new **Fisher Catalog Supplement.** The supplement describes in just over 100 pages all of the instruments, apparatus, glassware, laboratory furniture and accessories added to Fisher stocks since the 1952 publication of the major catalog.

All items in the new supplement were selected and tested by the

(Continued on page 108A)

SPECIAL ATTACHMENTS for Water-Sewer Jobs Multiply Hydrocrane's Value

Special attachments, designed specifically for water and sewer jobs, make the all-hydraulic Bucyrus-Erie crane-hoe an even greater favorite among utilities. They not only speed specialized digging and cleaning jobs, but are equipped with quick change fittings — permit switching attachments in a few minutes.

Your Bucyrus-Erie distributor will demonstrate the all-hydraulic Hydrohoe or Hydrocrane — show you how custom-matched attachments can save time and money. Complete literature is yours for the asking. Write today.

Catch Basin Bucket

Closes hydraulically, opens by spring pressure. This unit has achieved outstanding results cleaning sewer catch basins. Bucket is 1⅓-cu. ft. capacity and only 15-in. in diameter when closed. This permits working through small manhole openings.

Hydrohoe Special "Utilities" Dipper

Tailor-made for water and sewer work users, this new 22-in. wide, wrist-action dipper is especially designed for digging holes of greater depth than length. Dipper rotates 95° from 45° behind handle to 50° ahead. Here is an invaluable attachment for digging manholes, valve and hydrant pits, uncovering pipe leaks.

New ⅜-yd. Clamshell Bucket

Long, sharp teeth quickly knife into tough clay and hardpan. Smooth clean bowls shed sticky dirt in a hurry. Bucket cleaner optional. Bucket closes by two hydraulically operated rams. Use of twin rams instead of single center ram provides 42 per cent more force to lips at point of closing.

66H55

Plus . . . Three-tine grapple, 1-yd. trash bucket, ½-yd. materials bucket, 12-, 18-, and 24-in. hoe dippers, crane hook, cab.

BUCYRUS-ERIE COMPANY South Milwaukee Wisconsin

St. Louis Turbidimeter

For measuring turbidity of water. Consists of cast aluminum housing, adjustable lamp . . . two vertical wells for holding two Nessler tubes.

This apparatus comes ready to plug into 115 volt line, comes fully equipped for normal operation.

WRITE:

Phipps & Bird, Inc.

P. O. Box 2V • Richmond 5, Va.

FOR MAKING SERVICE CONNECTIONS QUICKLY, EASILY!

SKINNER-SEAL SERVICE SADDLE

For steel, cast iron and Transite pipe. Single massive bolt. Sizes 1" to 12" inclusive. Write for catalog.

M. B. SKINNER COMPANY
SOUTH BEND 21, INDIANA

Fisher technical staff. Woodcuts as well as action photographs are used. There are dozens of new instruments, especially in the electrochemical, petroleum and clinical fields, newly developed and manufactured by Fisher.

Hagan Companies' Products and Services

121

Hagan Corporation, Pittsburgh, Pa., has just published a 28 page bulletin on the **Products and Services of The Hagan Companies.**

The bulletin summarizes the products and services of Hagan and its three subsidiaries: Calgon, Inc., Hall Laboratories, Inc., and the Buromin Company.

Automatic control and instrumentation components; water conditioning and steam testing equipment, chemical feeding devices; chemicals for food processing, paper processing and for metal protection are some of the subjects discussed in the bulletin.

Remote Metering And Control

122

Builders-Providence, Inc., Providence, R. I., has just published an 8-page color bulletin that describes how **Chronoflo Telemeters** bring accurate records and control over an unlimited distance to the fingertips of plant and industry operators.

Remote Metering of flow, level, pressure, temperature, gate position, and weight and control of pumps, chemical feeders, valves and levels are some of the Chronoflo functions covered in this bulletin.

Divided into 8 descriptive sections on various telemetering applications, the bulletin contains product photos and installation drawings in addition to a description of the system's operation.

Solids Handling Pump

123

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just released a bulletin describing the construction features of the **"Acap" Pump** for handling solids in suspension under variable capacity and head conditions.

According to the bulletin, the pump is designed specifically for applications in the paper industry and sewage plants, and is adjustable to most variable capacity and head conditions by means of an internal by-pass control.

The bulletin states that the pump

WACO ALUMINUM Custom Fabricated EQUIPMENT

including

- Stop Gates & Guides
- Weir Plates • Bar Screens
- Gratings & Frames
- Walkways • Manhole Covers
- Steps & Ladders

Write for literature

WASHINGTON ALUMINUM COMPANY, INCORPORATED
BALTIMORE 29, MARYLAND
Phone: ARBUTUS 2700

NEW YORK: Murray Hill 7-0926
BOSTON: Liberty 2-7917
CLEVELAND: Yellowstone 2-6107
HOUSTON: Blackstone 6388
MOBILE: Hemlock 2-4466
NEW ORLEANS: Raymond 9744
SAN FRANCISCO: Yukon 6-2803
SEATTLE: Main 8930

the search for PURE WATER
354 B.C.
"Hippocrates' sleeve" (a cloth straining bag) was a popular water treatment method in the 4th Century B.C.

For excellence in MODERN water treatment equipment —gravity and pressure filters— recirculation apparatus...

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MANUFACTURING CO.
607 COLUMBIA AVE., DARBY, PA.

is available in a wide range of capacities and heads and can be either manually or automatically controlled.

Venturi Tubes And Nozzles

124

Simplex Valve & Meter Company, Lancaster, Pa., has just issued a bulletin on **Insert Venturi Tubes and Nozzles.**

The comprehensive and well documented 4-page bulletin discusses factors such as the effect of temperature, high line pressures, handling of corrosive fluids during measurement of fluid flow and its various ramifications.

Describing the Simplex type TG venturi tubes and nozzles, this assembly has been developed for applications in process industries, power plants, testing laboratories, and in main-line metering. Data on advantages, construction and installation details, range of sizes and specifications is given in simplified form.

Instrumentation for Feeders

125

Omega Machine Company, Providence, R. I., has available an 8 page preprint on the application of **Principles of Instrumentation To Liquid and Dry Feeders.**

This preprint, presented at the 10th Annual Instrument-Automation Conference of the ISA, contains 11 flow-parts diagrams, and is part one on "Controllers". Purpose of this paper is to provide a basic knowledge of the application of instrument principles to gravimetric feeders, especially the function of the controller in its various forms.

Laboratory Equipment and Furniture Catalog

126

Metalab Equipment Company, Hicksville, Long Island, N. Y., has just published a 12-page catalog showing the latest design in **Laboratory Furniture** of all types. Some of the types of equipment featured in the catalog are: Center Tables, Wall Tables, Fume Hoods, Radioactive Fume Hoods, Storage Cabinets, Sectional Units, Service Fixtures, and other types of allied equipment for the laboratory. The catalog also covers new Sectional Units, Table Top Materials, and Special Units which can be used in conjunction with all laboratory equipment.

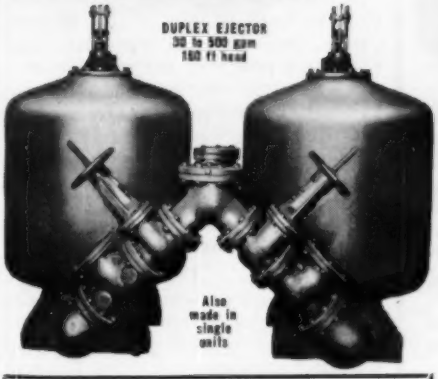
(Continued on page 110A)

Today's Facts on Modern **SEWAGE EJECTION**

Blackburn-Smith Mfg. Co., Inc.
51 Garden Street, Hoboken, N. J.

I want to know how I can get better sewage ejection at lower cost.

Name.....
Company.....
Address.....
.....



Features of BLACKBURN-SMITH EJECTORS

Switches operated automatically by float and electrical controls.
Snap-action valve controlled automatically, pneumatically and by float. Electrode controls.
Compact . . . motor compressor assembly and controls in "one package" unit.
Steel construction. Welded steel pots.
Simple piping for air, water.
No clogging screens, impellers, shredders.
No messy pump cleaning. Sanitary.
Unfailing, dependable operation.

BULLETIN S-50
for look-ahead municipal engineers

Get the facts you want on how to eliminate costly, complex piping for air and water, messy, unsanitary screens, impellers, shredders, expensive pump cleaning . . . in short, the facts on simple, dependable, economical, clean Blackburn-Smith Ejectors.

Valves and switches are controlled automatically for unfailing operation by electricity, by floats, and by pneumatic action. Learn how simple, compact, and inexpensive they are to install, operate, and maintain compared to complicated systems. *Get today's facts today—Send the coupon in now!*

BLACKBURN-SMITH MFG. CO., INC.
51 GARDEN ST., HOBOKEN, N. J.
HO 3-4425 • N. Y. Tel., BA 7-0600

CEMENT GUN CO. USES "GUNITE" FOR DISPOSAL PLANT REPAIRS

The top photo shows badly disintegrated concrete Imhoff Tank of a small New Jersey Sewage Disposal Plant. The repairs involved removal and rebuilding of two walls of this tank in their entirety, together with the relining of the tank with two inch "GUNITE."

The two trickling filters were also repaired with "GUNITE" to a thickness of two inches both inside and outside, as well as rebuilding sections of the circular wall. On the interior of the trickling filters the "GUNITE" was carried down eighteen inches below rock line.

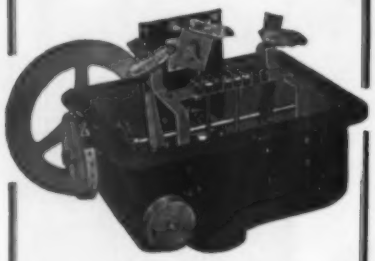
The repairs illustrated above have restored the Plant at small expense to original design.

Many varied types of repair, remodeling and new construction with "GUNITE" are described and illustrated in our Bulletin C-3000. A request on your letterhead will bring a free copy by return mail.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES – ALLENTOWN, PA., U. S. A.
MANUFACTURERS OF THE "CEMENT GUN"

• If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

ROTO-TROL



RF-2

WITH ALTO-TROL

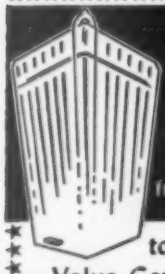
This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles. The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

WATER LEVEL CONTROLS DIVISION

HEALY-RUFF COMPANY

783 HAMPDEN AVE., ST. PAUL 4, MINN.



They Come to New York from everywhere

to enjoy the Value, Comfort and Convenience of the

HOTEL Woodward

BROADWAY at 55th STREET

Ideal accommodations for 800 guests

Private baths, showers and radio. Television!

FROM $3.50 SINGLE $5.00 DOUBLE

All-Purpose Diaphragm Pump

127

Proportioneers, Inc., Providence, R. I., has just published a supplementary bulletin on their **All-Purpose Diaphragm Pump** for feeding chemicals. The bulletin discusses a solution to the problem of safely and dependably feeding a variety of chemical solutions.

The bulletin tells of this all-purpose, positive displacement, diaphragm pump in informative sections on the unit's operation, construction, and advantages as well as including an operating data table, performance curve, and a list of chemical solutions.

Chlorine Feeding

128

Builders-Providence, Inc., Providence, R. I., has just issued a four-page supplementary bulletin on **Semi-Automatic and Step Control Methods of Chlorinizers.**

This bulletin, complete with photographs, typical installation and control arrangement diagrams, is divided into two sections—Semi-Automatic Control and Step Control. These methods may be used in such applications as: municipal and industrial waste treatment, intermittently operated pump discharge, elevated tank storage, industrial processes, batch solutions, and slime control.

Tight-Closing Rate of Flow Controller

129

Builders-Providence, Inc., Providence, R. I., has just published a four-page bulletin on a **Power Actuated Rate of Flow Controller** of advanced design for the effective operation of water, waste, or industrial plants.

The bulletin contains descriptive information on the operation and installation in addition to photos, flow diagrams, and tables. One of the two models described, the RCB-T, comes equipped with a rubber-seated butterfly valve for tight-closure.

Pipe Tool Catalog

130

Beaver Pipe Tools, Inc., Warren, Ohio, has just released a revised publication of the **Beaver Quick-Reference Catalog.**

The revised catalog presents many recent changes in Beaver products which include improvements on Beaver's No. 26-R and No. 28-R Threaders; a new No. 17 Lightweight Ratchet Threader; a remodeled and redesigned Model-A High Speed Portable Pipe Machine; a new Power Grip Chuck; a new Quadra-Type Diehead; a new Model-D Power Drive and the all new No. 78 Quick-Opening Quadra-type Threader.

Other changes on Beaver products include a new line of geared pipe cutters which will cut and groove pipe for mechanical couplings in one operation. They will also cut and strip Saran pipe in one operation.

A new Beaver product, the Speed-Cut Abrasive Cutting Machine, also is presented on the back.

Infilco Clarifiers And Thickeners

131

Infilco Inc., Tucson, Arizona, has just published a bulletin on **Infilco Clarifiers and Thickeners.**

Questions on design requirements of clarifiers and thickeners for a wide range of capacities and solids removal loads are informatively answered in this sixteen-page, easy-to-read, graphically illustrated booklet.

The bulletin explains fully why circular sedimentation basins, sludge scrapers and central inlet wells are features of Infilco Clarifiers and Thickeners.

CIVIL ENGINEER

New position of Civil Engineer II recently created in Water Dept. at Madison, Wis. Salary $472 to $552 a month with longevity increases to $593 for design and construction engineer with experience. Starting salary may be above the minimum.

Two weeks vacation, three weeks after extended employment; 5-day week; sick leave; Wisconsin Retirement Fund and Social Security benefits. Personnel Dept. City Hall, Madison 3, Wis.

SERVICE ENGINEER

For leading manufacturer of nationally advertised equipment used in the purification of water, sewage and industrial wastes. Applicants must have experience in operation and maintenance of water, sewage or waste treatment plants and be willing to travel. Prefer men already located near openings available in Michigan, Ohio and mid-western New York. Write, giving full information and salary desired, c/o Box 1134, WATER & SEWAGE WORKS, 185 N. Wabash Ave., Chicago, Illinois.

Consulting Engineers

SPECIALIZING IN THE FIELD OF

WATER & SEWAGE WORKS

ALBRIGHT & FRIEL INC.

Consulting Engineers

Water, Sewage, Industrial Wastes and Incineration Problems—City Planning, Highways, Bridges and Airports—Dams, Flood Control, Industrial Buildings—Investigations, Reports, Appraisals and Rates—Laboratory for Chemical & Bacteriological Analyses—Complete Service on Design and Supervision of Construction.

Three Penn Center Plaza
Philadelphia 2, Pa.

Alvord, Burdick & Howson

Engineers

Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation

20 N. Wacker Drive. Chicago 6, Ill.

JOHN J. BAFFA

Consulting Engineer

Water Supply and Treatment
Sewerage and Sewage Treatment

75 West Street New York 6, N. Y.

MICHAEL BAKER, JR., INC.

The Baker Engineers

Civil Engineers, Planners, and Surveyors

Airports, Highways, Sewage Disposal Systems, Water Works Design and Operation—City Planning—Municipal Engineering—All types of Surveys

Home Office: Rochester, Pa.
Branch Offices:
Jackson, Miss. Harrisburg, Pa.

W. H. & L. D. BETZ

CONSULTING ENGINEERS

INDUSTRIAL WASTE
INDUSTRIAL WATER
ANALYSIS DESIGN
INVESTIGATIONS OPERATION

Gillingham & Worth Sts.
Philadelphia 24, Pa.

BLACK & VEATCH

Consulting Engineers

Water — Sewage — Electricity
Industry

Reports, Design, Supervision of Construction, Investigations, Valuation and Rates

4706 Broadway, Kansas City 2, Missouri

BOGERT AND CHILDS

CONSULTING ENGINEERS

Clinton L. Bogert — **Fred S. Childs**
Ivan L. Bogert — **Donald M. Ditmars**
Robert A. Lincoln — **Charles A. Manganaro**
William Martin

Water & Sewage Works • Refuse Disposal Drainage • Flood Control • Highways and Bridges • Airfields

145 East 32nd Street, New York 16, N. Y.

BOYLE ENGINEERING

Consulting Engineers

Water — Sewers — Streets
Structures — Surveys
Reports — Special Districts

331 Spurgeon Bldg. 3913 Ohio, Rm. 200
Santa Ana, Calif. San Diego 4, Calif.

Bowe, Albertson & Associates

Engineers

Water and Sewage Works—Industrial Wastes—Refuse Disposal—Municipal Projects—Industrial Buildings—Reports—Plans—Specifications—Supervision of Construction and Operation—Valuations—Laboratory Service

75 West Street New York 6, New York

Buck, Seifert and Jost

Consulting Engineers

Water Supply, Sewage Disposal, Hydraulic Developments, Reports, Investigations, Valuations, Rates, Design Construction Operation Management, Chemical and Biological Laboratories

112 East 19th St. New York

BURGESS & NIPLE

Civil and Sanitary Engineers

Water Supply and Purification
Sewerage and Sewage Treatment
Appraisals, Reports, Valuations

2015 West Fifth Avenue
Columbus 12, Ohio

BURNS & McDONNELL

Consulting and Designing Engineers

Kansas City, Mo. — **Cleveland, Ohio**
P.O. Box 7088 — **1404 E. 9th St.**

Camp, Dresser & McKee

Consulting Engineers

6 Beacon Street, Boston 8, Mass.

Water Works and Water Treatment; Sewerage and Sewage Treatment; Municipal and Industrial Wastes; Investigations and Reports; Design and Supervision; Research and Development; Flood Control.

CAPITOL ENGINEERING CORPORATION

Engineers—Constructors—Management

SEWAGE SYSTEMS — Designs and Surveys, Planning, Bridges
WATER WORKS — Roads and Streets, Airports, Dams

Executive Offices
DILLSBURG, PENNSYLVANIA

The Chester Engineers

Water Supply and Purification—Sewage and Industrial Waste Treatment—Power Plants—Incineration—Gas Systems—Valuations — Rates — Management — Laboratory—City Planning

210 E. Park Way,
Pittsburgh 12, Penna.

Chas. W. Cole & Son

Engineers — Architects

Sewerage, Water Supply, Bridges, Highways, Toll Roads, Industrial, Municipal and Commercial Buildings

220 W. LaSalle Ave., South Bend, Indiana
Central 4-0127

CONSOER, TOWNSEND & ASSOCIATES

Water Supply, Sewerage, Flood Control & Drainage, Bridges, Express Highways, Paving, Power Plants, Appraisals, Reports, Traffic Studies, Airports, Gas & Electric Transmission Lines.

351 East Ohio St., Chicago 11, Illinois

COTTON, PIERCE, STREANDER, INC.

Associated Engineering Consultants

132 Nassau St., New York, N. Y.
6 Beacon St., Boston, Mass.
55 Caroline Rd., Gowanda, N. Y.
2718 Garfield St., Hollywood, Fla.

Water Supply Treatment, Distribution, Sewerage, Sewage Treatment, Refuse Disposal, Trade Wastes, Power Plants, Reports, Plans, Supervision.

DE LEUW, CATHER & COMPANY

Water Supply — Sewerage
Railroads — Highways
Grade Separations—Bridges—Subways
Local Transportation

Investigations — Reports — Appraisals
Plans and Supervision of Construction

150 North Wacker Drive Chicago
79 McAllister Street San Francisco 2, Calif.

FAY, SPOFFORD & THORNDIKE

Engineers

John Ayer — Ralph W. Horne
Elon A. Bowman — William L. Nyland
Carroll A. Farwell — Frank L. Lincoln
Howard J. Williams

Water Supply and Distribution—Drainage
Sewerage and Sewage Treatment
Airports—Bridges—Turnpikes
Port and Terminal Works — Industrial Bldgs.
Investigations, Reports, Designs, Valuations
Supervision of Construction

BOSTON NEW YORK

FINKBEINER, PETTIS & STROUT

Carleton S. Finkbeiner, C. E. Pettis, Harold K. Strout

Consulting Engineers

Reports Designs Supervision

Water Supply, Water Treatment, Sewerage, Sewage Treatment, Wastes Treatment, Valuations & Appraisals.

518 Jefferson Avenue Toledo 4, Ohio

Additional Engineers Cards on Next Page

F. R. FRIEDEWALD
CONSULTING ENGINEER
Waterworks ★ Sewage ★ Gas Supply and Distribution ★ Drainage ★ Street Improvements
Estimates ★ Reports ★ Surveys
311 SOUTH FIRST ST., BELLEVILLE, ILLINOIS
Phone: Belleville 3225

Hayden, Harding & Buchanan
Consulting Engineers
John L. Hayden
John H. Harding Oscar J. Campia
Waterworks, Sewerage, Civil, Mechanical, Electrical, Structural
810 Park Square Building, Boston, Mass.

Morris Knowles, Inc.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning
1312 Park Building, Pittsburgh, Pa.

Freese, Nichols and Turner
CONSULTING ENGINEERS
2111 NATIONAL STANDARD BUILDING
HOUSTON 2, TEXAS
CH-1624

HAZEN AND SAWYER
Engineers
Richard Hazen Alfred W. Sawyer
Municipal and Industrial Water Supply Purification and Distribution
Sewage Works and Waste Disposal
Investigations, Design, Supervision of Construction and Operation
122 East 42nd Street New York 17, N.Y.

LANNING
Sanitary Engineering Co., Inc.
Consulting Engineers
Professional Building
1100 South Broad Street
Trenton New Jersey

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Engineers
HARRISBURG, PA.
Pittsburgh, Pa. Daytona Beach, Fla.
Philadelphia, Pa. Pleasantville, N. J.
Water Works, Sewage, Industrial Wastes and Garbage Disposal—Roads, Airports, Bridges, Flood Control, Traffic & Parking, Appraisals, Investigations & Reports.

HENNINGSON, DURHAM & RICHARDSON
Consulting Engineers since 1917 for more than 700 cities and towns.
Water Works, Light and Power, Sewers, Sewage Treatment, Reports, Flood Control, Appraisals, Drainage, Paving.
2962 Harney St., Omaha 2, Nebraska

LOCKWOOD GREENE ENGINEERS, INC.
Architects - Engineers
Montgomery Building
SPARTANBURG, S. C.
Water Supply—Power Plants
Sewage Disposal—Valuations & Appraisals
Industrial Waste — Industrial Plant Design

GILBERT ASSOCIATES, INC.
Engineers and Consultants
Water Supply and Purification
Sewage and Industrial Waste Treatment
Chemical Laboratory Service
Investigations and Reports
New York Reading, Pa. Washington
Houston Philadelphia

JAMES and BAXTER Associates, Inc.
Architects and Engineers
A complete professional service
Architectural, Civil, Industrial, Municipal
2962-64 Coral Way, Miami 34, FLORIDA

WM. S. LOZIER CO.
Sewerage, Sewage Disposal, Water Supply, Water Purification
Refuse Disposal
Consulting Engineers
10 Gibbs Street Rochester 4, N. Y.

GLACE AND GLACE
Consulting Sanitary Engineers
WATER SUPPLY AND PURIFICATION
SEWERAGE AND SEWAGE TREATMENT
Design, Construction and Supervision of Operation
1001 North Front St. Harrisburg, Pa.

The Jennings-Lawrence Co.
Civil & Municipal Engineers
Consultants
Water Supply, Treatment & Distribution
Sewers & Sewage Treatment
Reports — Design — Construction
1392 King Ave. Columbus 12, Ohio

Metcalf & Eddy
Engineers
Water, Sewage, Drainage, Refuse and Industrial Waste Problems
Airports Valuations
Laboratory
Statler Building, Boston 16

GREELEY AND HANSEN
Engineers
Samuel A. Greeley Paul Hansen (1920-1944)
Paul E. Langdon Kenneth V. Hill
Thomas M. Niles Samuel M. Clarke
Water Supply, Water Purification
Sewerage, Sewage Treatment
Flood Control, Drainage, Refuse Disposal
220 S. State Street, Chicago 4

Jones, Henry & Williams
Consulting Sanitary Engineers
Water Works
Sewerage & Treatment
Waste Disposal
821 Security Bldg. Toledo 4, Ohio

NUSSBAUMER, CLARKE & VELZY, INC.
Newell L. Nussbaumer—Irving Clarke—Charles R. Velzy
Water Supply and Treatment
Sewerage & Sewage Disposal
Garbage Incineration
Municipal Planning
500 Fifth Avenue, New York 36, N. Y.
327 Franklin St. Buffalo, N. Y.

HASKINS, RIDDLE & SHARP
Consulting Engineers
Water—Sewage & Industrial Wastes—Hydraulics
Reports, Design, Supervision of Construction
Appraisals, Valuations, Rate Studies
1009 Baltimore Ave. Kansas City 5, Mo.

R. L. KENAN & ASSOCIATES
CONSULTING ENGINEERS
Water Works, Flood Control, Sewerage, Sewage Disposal, Airports, Harbor and Waterfront Improvements.
MONTGOMERY, ALA. PENSACOLA, FLA.

PARSONS, BRINCKERHOFF HALL & MACDONALD
G. Gale Dixon, Associate
Wellington Donaldson, Staff Consultant
Water, Sewage, Drainage and Industrial Waste Problems.
Structures — Power — Transportation
51 Broadway New York 6, N.Y.

HAVENS AND EMERSON
W. L. HAVENS
A. A. BURGER F. W. JONES
J. W. AVERY H. H. MOSELEY
F. S. PALOCSAY E. S. ORDWAY
F. C. TOLLES, CONSULTANT
CONSULTING ENGINEERS
WATER, SEWERAGE, GARBAGE, INDUSTRIAL WASTES VALUATIONS—LABORATORIES
LEADER BLDG. WOOLWORTH BLDG.
CLEVELAND 14, O. NEW YORK 7, N.Y.

Engineering Office of
CLYDE C. KENNEDY
SANITARY ENGINEERING
SAN FRANCISCO

MALCOLM PIRNIE ENGINEERS
Malcolm Pirnie Ernest W. Whitlock
Robert D. Mitchell Carl A. Arenander
Malcolm Pirnie, Jr.
MUNICIPAL AND INDUSTRIAL
Water Supply - Water Treatment
Sewage and Waste Treatment
Drainage - Sewerage - Refuse Disposal
25 West 43rd St. New York 36, N. Y.

Additional Engineers Cards on Next Page

THE PITOMETER ASSOCIATES, INC.
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Water Measurements & Special Hydraulic Investigations
New York, 50 Church Street

J. E. SIRRINE Company
Engineers
Water Supply & Purification
Sewage & Industrial Waste Disposal
Stream Pollution Reports
Utilities, Analyses
Greenville, South Carolina

Wertz Engineering Co., Inc.
Consultants, Designers & Constructors
Water Supply & Purification
Sewage & Industrial Waste Treatment
Stream Pollution Studies
Chemical & Bact. Laboratory Service.
441 North 2nd St. Reading, Pa.

LEE T. PURCELL
Consulting Engineers
Water Supply & Purification; Sewerage & Sewage Disposal; Industrial Wastes; Investigations & Reports; Design; Supervision of Construction & Operation
Analytical Laboratories
38 De Grasse Street, Paterson 1, N.J.

Benjamin L. Smith & Associates
Engineers
Investigations — Reports
Designs — Supervision — Valuations
Municipal Engineering and Public Utilities
11 North Pearl Street
Albany 7, New York

WESTON, ECKENFELDER AND ASSOCIATES
Consultants
Engineers • Biologists • Chemists
Industrial Wastes
Stream Pollution - Air Pollution
Water - Sewage
Surveys - Research - Development - Process Engineering - Operation Supervision - Analyses Evaluations and Reports
Newtown Square, Pa. Leonia, N. J.

Thomas M. Riddick
Consulting Engineer and Chemist
Municipal and Industrial Water Purification, Sewage Treatment, Plant Supervision, Stream Pollution Investigations, Chemical and Bacteriological Analyses.
369 East 149th Street
New York 55, N. Y.

STANLEY ENGINEERING COMPANY
Consulting Engineers
327 S. LaSalle St. Chicago 4, Ill.
Hershey Building Muscatine, Iowa

Weston & Sampson
Water Supply, Water Purification, Sewerage, Sewage and Industrial Waste Treatment, Corrosion Control, Laboratory Service Supervision, Valuations
14 Beacon St. Boston, Mass.

ROBERT AND COMPANY ASSOCIATES
Engineering Division
ATLANTA

Alden E. Stilson & Associates
Limited
Consulting Engineers
Water Supply—Sewage—Waste Disposal
Bridges—Highways—Industrial Buildings
Studies—Surveys—Reports
245 North High St. Columbus, Ohio

Whitman & Howard
Engineers (Est. 1869)
Water Supply, Water Purification, Sewerage, Sewage Disposal, Water Front Improvements and all Municipal and Industrial Development Problems, Investigations, Reports, Designs, Supervision, Valuations.
89 Broad St., Boston, Mass.

RUSSELL AND AXON
Consulting Engineers
Civil—Sanitary—Structural
Industrial—Electrical
Rate Investigations
408 Olive St., St. Louis 2, Mo.
Municipal Airport, Daytona Beach, Fla.

UHLMANN & ASSOCIATES
PAUL A. UHLMANN H. E. BONHAM
CARL E. KUCK NYE GRANT
Consulting Engineers
Water Supply and Purification
Sewage and Industrial Waste Treatment
4954-58 N. High St. Columbus 14, O.

WHITMAN, REQUARDT & ASSOCIATES
Engineers — Consultants
Civil—Sanitary—Structural—Mechanical—Electrical
Reports, Plans, Supervision, Appraisals
1304 St. Paul Street
Baltimore 2, Maryland

MR. CONSULTING ENGINEER
Are you interested in both
WATER & SEWAGE
If so there is no better place for your professional card than in this dual interest magazine.
WATER & SEWAGE WORKS

WANTED

Assistant Plant Maintenance Supervisor, Water Department. Requirements: equivalent to degree in mechanical or electrical engineering. Four years of experience in plant construction, maintenance, and repair. Salary range: $372 to $494 per month.

Assistant Water and Sewage Pumping Supervisor. Requirements: equivalent to degree in electrical or mechanical engineering. Two years of experience in water and sewage pumping operations and maintenance. Salary range: $402 to $533 per month.

Room 412, City Hall
DALLAS, TEXAS

FOR SALE

Reconditioned Black Pipe

8⅝" O.D. .322 wall 28.55 lbs. per foot—100,000 feet.

12¾" O.D. .375 wall 49.56 lbs. per foot—35,000 feet.

20-foot random lengths lapweld. Beveled ends ready for installation in gas, water, oil lines or structural purposes. Complete inventories of all sizes black and galvanized pipe also available.

Write—Wire—Phone

Sonken-Galamba Corporation
2nd and Riverview (X-160)
Kansas City 18, Kansas
ATwater 9305

Overlooking the Fenway
Boston, *Mass.*
Attractive, comfortable, homelike rooms, suites and kitchenettes—near Kenmore Square and Boston University. Modern, fireproof building. *from* $6 double
FAMILY PLAN
Special rates for permanent guests.
Hotel **CANTERBURY**
14 Charlesgate West, Boston, Mass.

INDEX TO ADVERTISERS

A

Albright & Friel, Inc. 111A
Alvord, Burdick & Howson 111A
American Vitrified Products Co. 97A
*Anthracite Equipment Corp. 84A

B

Badger Meter Mfg. Co. 16A
Baffa, John J. 111A
Baker, Jr., Michael 111A
Beckman Instr. Inc. 91A
*Bethlehem Steel Company 99A
Betz, W. H. & L. D. 111A
*B-I-F Industries, Inc. ..... Inside Back Cover
*Blackburn-Smith Mfg. Co. 109A
Black & Veatch 111A
Bogert and Childs 111A
Bowe, Albertson & Associates 111A
Boyle Engineering 111A
Buck, Seifert and Jost 111A
Bucyrus-Erie 107A
Buffalo Meter Co. 13A
*Builders-Providence, Inc. ..... Inside Back Cover
Burgess & Niple 111A
Burns & McDonnell 111A
Byers Company, A. M. 31A

C

Camp, Dresser & McKee 111A
Capitol Engineering Corporation 111A
Carborundum Co. 28A
Cast Iron Pipe Research Ass'n 6A-7A
Cement-Gun Co. 109A
Chester Engineers, The 111A
*Chicago Bridge & Iron Co. 17A
*Chicago Pump Company 81A
Cleveland Trencher Co. 101A
Climax Engine & Pump Mfg. Co. 94A
Clow & Sons, James B. 8A
Cole & Son, Chas. W. 111A
Columbia Southern Chemical Co. 87A
*Combustion Engineering, Inc. 9A
Consoer, Townsend & Associates 111A
Cotton, Pierce, Streander, Inc. 111A

D

Darling Valve & Mfg. Co. 14A
DeLaval Steam Turbine Co. 20A
DeLeuw, Cather & Company 111A

E

Eddy Valve Co. 10A

F

Fay, Spofford & Thorndike 111A
Finkbeiner, Pettis & Strout 111A
*Fischer & Porter Co. 27A
Flexible, Inc. 82A
Ford Meter Box Co. 106A
Freese, Nichols & Turner 112A
Friedewald, F. R. 112A

G

Gannett Fleming Corddry and Carpenter, Inc. 112A
Gilbert Associates, Inc. 112A
Glace & Glace 112A
Greeley & Hansen 112A

H

Hamilton-Kent Manufacturing Co. 25A
*Hardinge Company, Inc. 98A
Haskins, Riddle & Sharp 112A
Havens & Emerson 112A
Hayden, Harding & Buchanan 112A
Hazen & Sawyer 112A
Healy-Ruff Company 110A
Henningson, Durham & Richardson 112A
Hersey Manufacturing Company 22A
Homelite Corp. 3A
Hotel Canterbury 113A
Hydraulic Development Corp. 105A

I

Iowa Valve Co. 12A
Industrial Chemical Sales 30A
Infilco Inc. 85A

J

James & Baxter Associates, Inc. 112A
Jennings-Lawrence Co., The 112A
Jones, Henry & Williams 112A

K

Keasbey & Mattison Company 26A
Kenan & Associates, R. L. 112A
Kennedy, Clyde C. 112A
Knowles, Inc., Morris 112A

L

Lanning 112A
*Leopold & Co., Inc., F. B. 84A
*Link-Belt Company 33A
Lock Joint Pipe Company ..... Inside Front Cover
Lockwood Greene Engrs. Inc. 112A
Lozier Co., Wm. S. 112A

M

*M & H Valve & Fittings Co. 90A
Metcalf & Eddy 112A
Minneapolis-Honeywell Reg. Co. 18A
*Mueller Company 15A

N

*Neptune Meter Company 34A
Niagara Alkali Company 89A
Nussbaumer, Clarke & Velzy, Inc. 112A

O

*Olin-Mathieson Chem. Co. 29A
Oliver Corp. 21A

P

*Pacific Flush Tank Company 24A
Parsons, Brickerhoff, Hall & MacDonald 112A
*Permutit Co. 4A
*Phipps & Bird, Inc. 108A
Pirnie Engineers, Malcolm 112A
Pitometer Associates, Inc., The 113A
*Pittsburgh Coke & Chemical Co. 23A
*Pittsburgh-Des Moines Steel Co. 32A
Pratt Co., Henry 104A
Preload Co. 88A
*Price Bros. Company 83A
Purcell, Lee T. 113A

R

Riddick, Thomas M. 113A
Robert and Company Associates 113A
*Roberts Filter Co. 108A
Rockwell Mfg. Co. 19A
Rockwell Co., W. S. 102A
Roots-Connersville Blower Division 103A
Russell and Axon 113A

S

Sirrine Company, J. E. 113A
Skinner Company, M. B. 108A
Smith & Associates, Benjamin L. 113A
*Smith & Loveless, Inc. 100A
Smith Co., S. Morgan 86A
Standard Dry Wall Products Co. 105A
Stanley Engineering Company 113A
Stilson & Associates, Alden E. 113A
Stuart Corp. 84A

T

*Tennessee Corporation 93A

U

Uhlman & Associates 113A
*U. S. Pipe & Foundry Co. 11A
U. S. Rubber 95A

W

*Wallace & Tiernan, Inc. ..... Back Cover
Washington Aluminum Co. 108A
Weinman Pump Mfg. Co. 96A
Wertz Engineering Co., Inc. 113A
Weston, Eckenfelder, Inc. 113A
Weston & Sampson 113A
C. H. Wheeler Mfg. Co., Div. of Economy Pumps 92A
Whitman & Howard 113A
Whitman, Requardt & Associates 113A

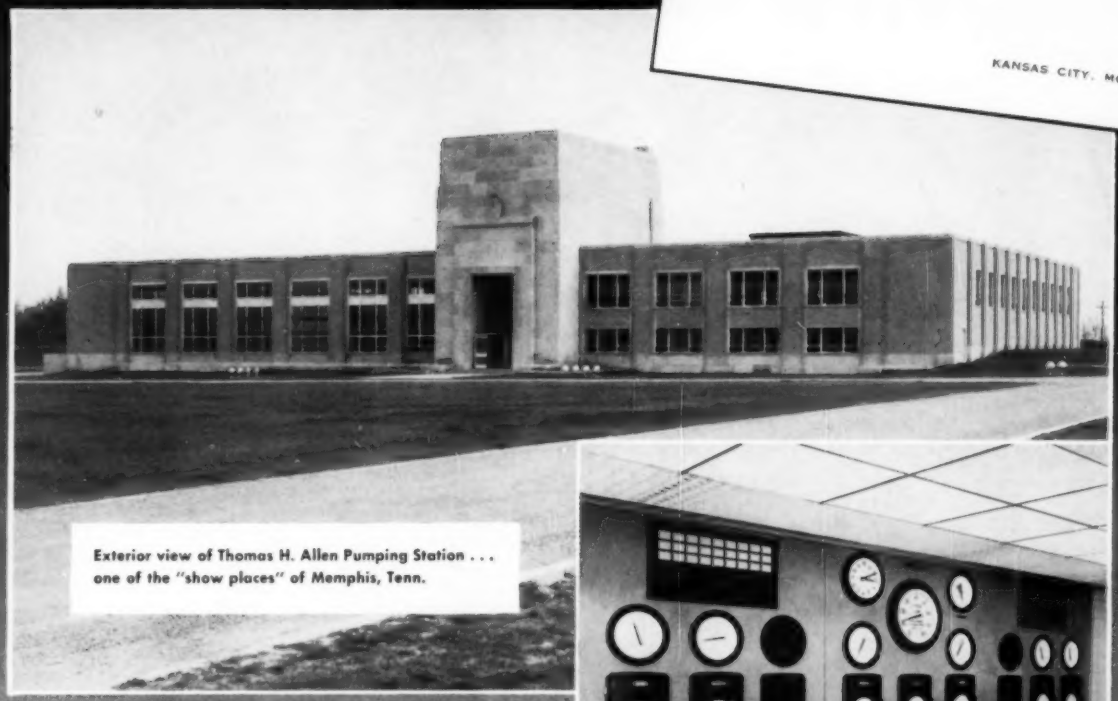
*Advertisers represented in the Annual 1955 Reference and Data Edition with Catalog specifications copy. Please refer to that issue for additional information concerning their products or equipment.

MEMPHIS, TENN.

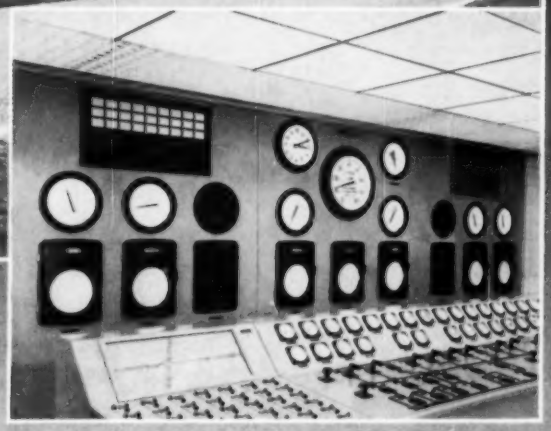
Thomas H. Allen Pumping Station

(COMPLETED IN 1953)

BLACK AND VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MO.



Exterior view of Thomas H. Allen Pumping Station . . . one of the "show places" of Memphis, Tenn.



Central Instrument Panel with annunciators. Chronoflo receiving instruments meter raw water, high service flows, high service summated flow, station pressure, wash water level, and reservoir level.

This modern pumping station is a good example of the present-day trend in municipal water plant design.

The Thomas H. Allen Station with two older stations serves an area of 121.5 square miles and a population of over 450,000. It incorporates the last word in metering and control equipment, integrated and centralized for maximum efficiency of plant operation. All important system functions concerned with water flows, pressures, and levels are metered by Builders-Providence equipment installed by the sub-contractors, Industrial Heating & Plumbing Co. of St. Joseph, Mo.

We will be glad to send you full information on the broad Builders line of up-to-date equipment for up-to-date water works service. For complete details write Builders-Providence, Inc., Providence 1, Rhode Island.

BUILDERS-PROVIDENCE

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • OMEGA MACHINE CO.

B-I-F METERS FEEDERS CONTROLS

CITY OF DALLAS
TEXAS
DEPARTMENT OF WATER WORKS
2121 COMMERCE STREET

TELEPHONE RA-5481

2605 Shore Crest Drive
Dallas 19, Texas
January 20, 1955

Wallace & Tiernan
1112 National City Building
Dallas 1, Texas

Gentlemen:

In answer to your recent inquiry, the Water Purification Division of the City of Dallas Water Department purchased its first chlorinator of the Wallace and Tiernan Water Diaphragm Type in April 1926.

Twelve chlorinators employing the water diaphragm principle have been purchased from your company for use in our system to protect and insure our water supply against the transmission of water borne diseases.

Just recently we completely reconditioned for the first time one of the chlorinators that had been in continuous service for over 17 years.

The performance of all these machines has been excellent and they have required only routine maintenance for dependable service.

Very truly yours,

Ben L. Grimes

Ben L. Grimes
Supervisor
Water Purification Plants

"....CONTINUOUS SERVICE *for over 17 years."*

In Dallas, Texas, The Water Purification Division recently "reconditioned for the first time one of the chlorinators that had been in continuous service for over 17 years", according to Mr. Ben L. Grimes, Supervisor, Water Purification Plants. This dependability and long life result not only from proper design, but from the selection of the right parts and materials for every specific purpose.

Since 1913, W&T research has consistently sought out new designs, principles and materials. Every new development is placed under rigid field tests to prove it can meet the exacting standards that dependable and economical chlorination demands.

When you depend on W&T equipment, you have the assurance that 40 years of experience in the chlorination field is being used to bring you the best in design, parts and materials—selected for long life and dependable service.

"Make Your First Choice Equipment That Lasts."

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

S-96